



Weather and Flight Testing

Edwards 412th
SCOTT WILEY
METEOROLOGIST
FLIGHT INSTRUCTOR

Flight Testing Weather Hazards

- Aircraft and Mission Dependent
- Turbulence
- Icing
- Thunderstorms
- Winds/Windshear
- IFR CIGS/VSBY
- Unknown Weather Hazards????
- Aircraft configuration susceptible

ICING

→ WORST: SLD ICING

- Supercooled Large Droplets
- Freezing Rain FZRA
- Freezing Drizzle FZDZ
- Ice pellets PL



Lessons learned

- De-ice boots/hot wings overwhelmed by SLD icing BEWARE RUNBACK
- Roll excursions and tailplane stalls are incideous and hints are:
 - Sloppy controls, ice on antenna, wipers but not on winshield or massive amount of ice

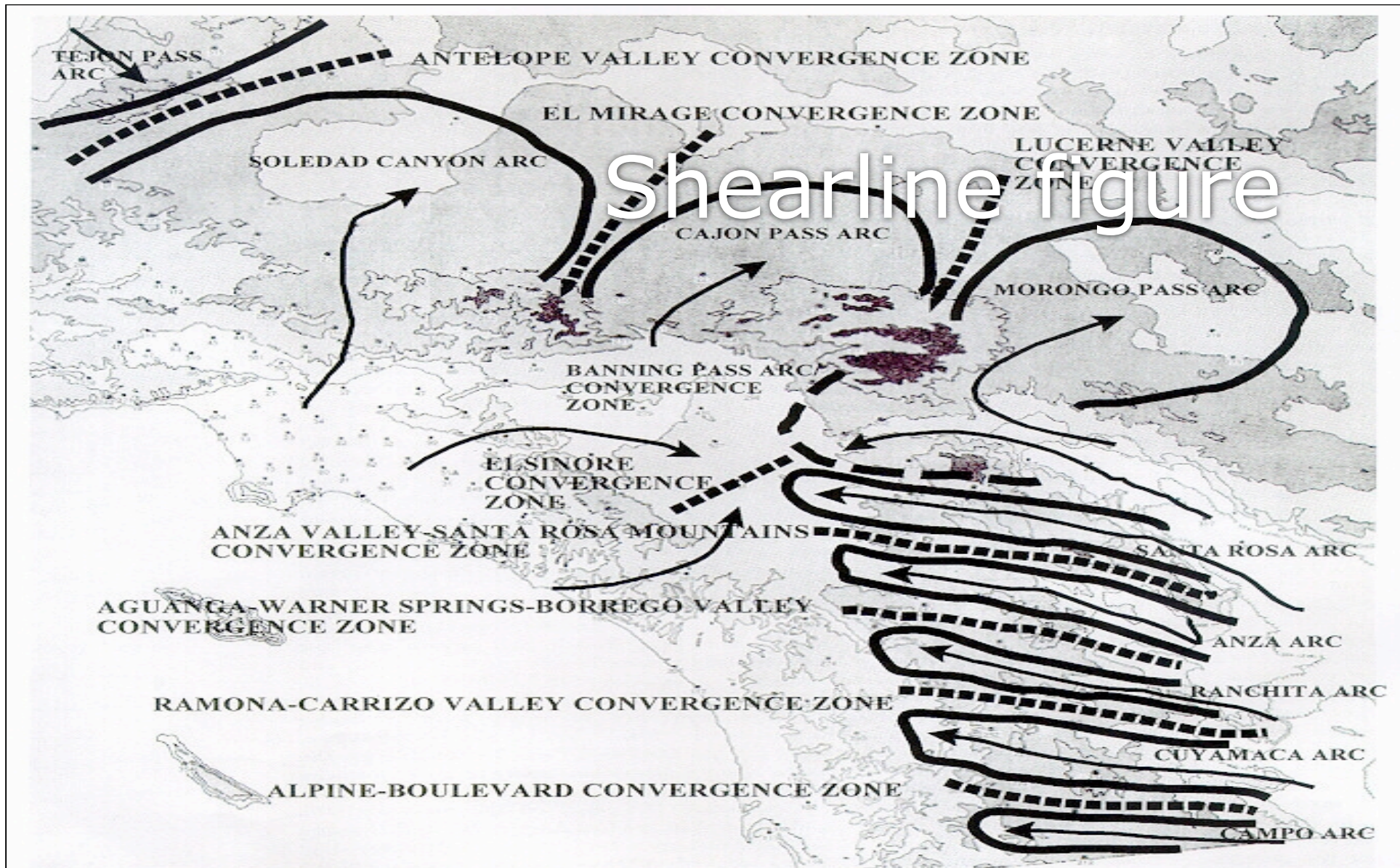


FIG. 7. Map of the terrain, low level flow through passes and canyons, and convergence zones for patterns when the southeasterly flow reaches the valley areas west of the mountains (Adapted from DeMarrais et al. 1965).

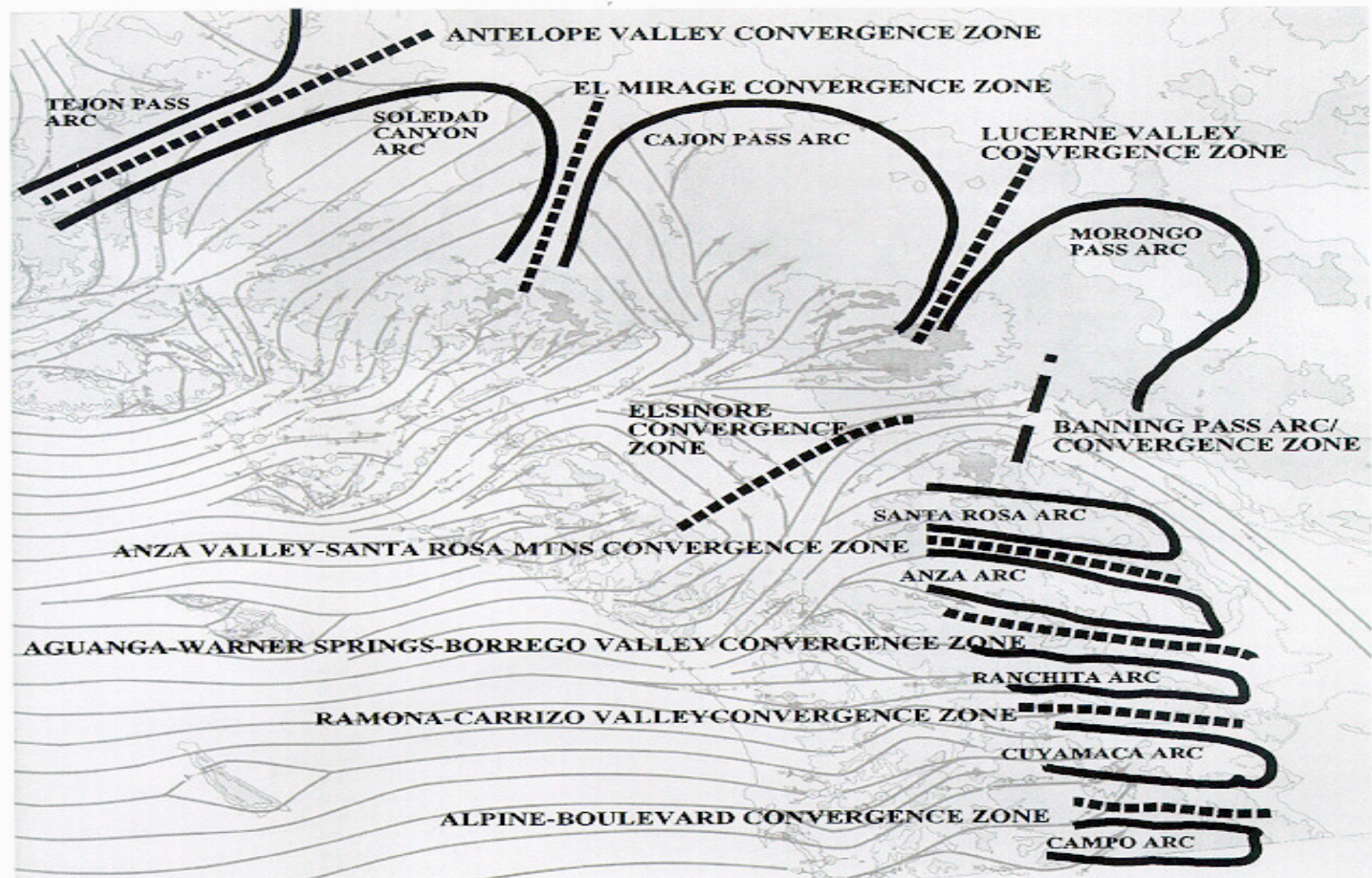


FIG. 6. Map of the terrain, low level flow through passes and canyons, and convergence zones for patterns when the westerly sea breeze flow pushes into the deserts (Adapted from DeMarrais et al. 1965).



Shearline thermals



Shearline wave hybrid



CLEAR AIR TURBULENCE-CAT



- CAT has catastrophic effects on aircraft
- Mountain wave flight into the rotor
- Aircraft landed safely, program cancelled

Boeing B-52H 'Stratofortress'
©USAF Museum Photo Archives



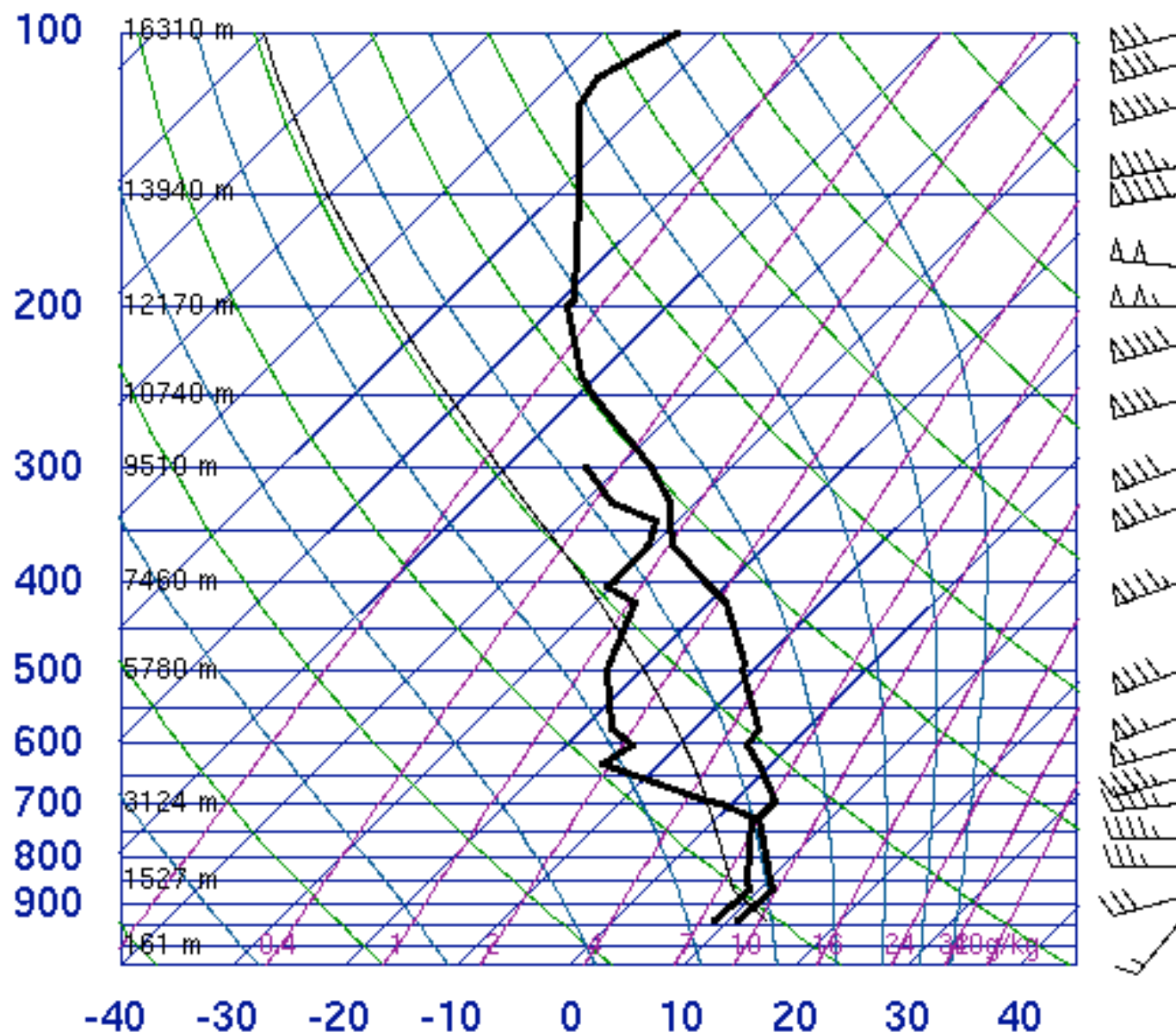
February 17, 1986

Scott,

This picture was taken
at Inyokern Feb 17, 1986, 4:30 PST.
It was a good wave day!!

Regards, Bob Harris

72381 EDW Edwards Afb



SLAT 34.90
 SLON -117.87
 SELV 702.0
 SHOW 5.12
 LIFT 8.65
 LFTV 8.59
 SWET 236.3
 KINX 25.10
 CTOT 19.10
 VTOT 21.30
 TOTL 40.40
 CAPE 0.00
 CAPV 0.00
 CINS 0.00
 CINV 0.00
 EQLV -9999
 EQTV -9999
 LFCT -9999
 LFCV -9999
 BRCH 0.00
 BRCV 0.00
 LCLT 281.4
 LCLP 880.4
 MLTH 291.9
 MLMR 7.88
 THCK 5619.
 PWAT 24.22

12Z 18 Feb 1986

University of Wyoming

Prev Next Stop Start Slower Faster Delete

72381 EDW Edwards Afb

100

200

300

400

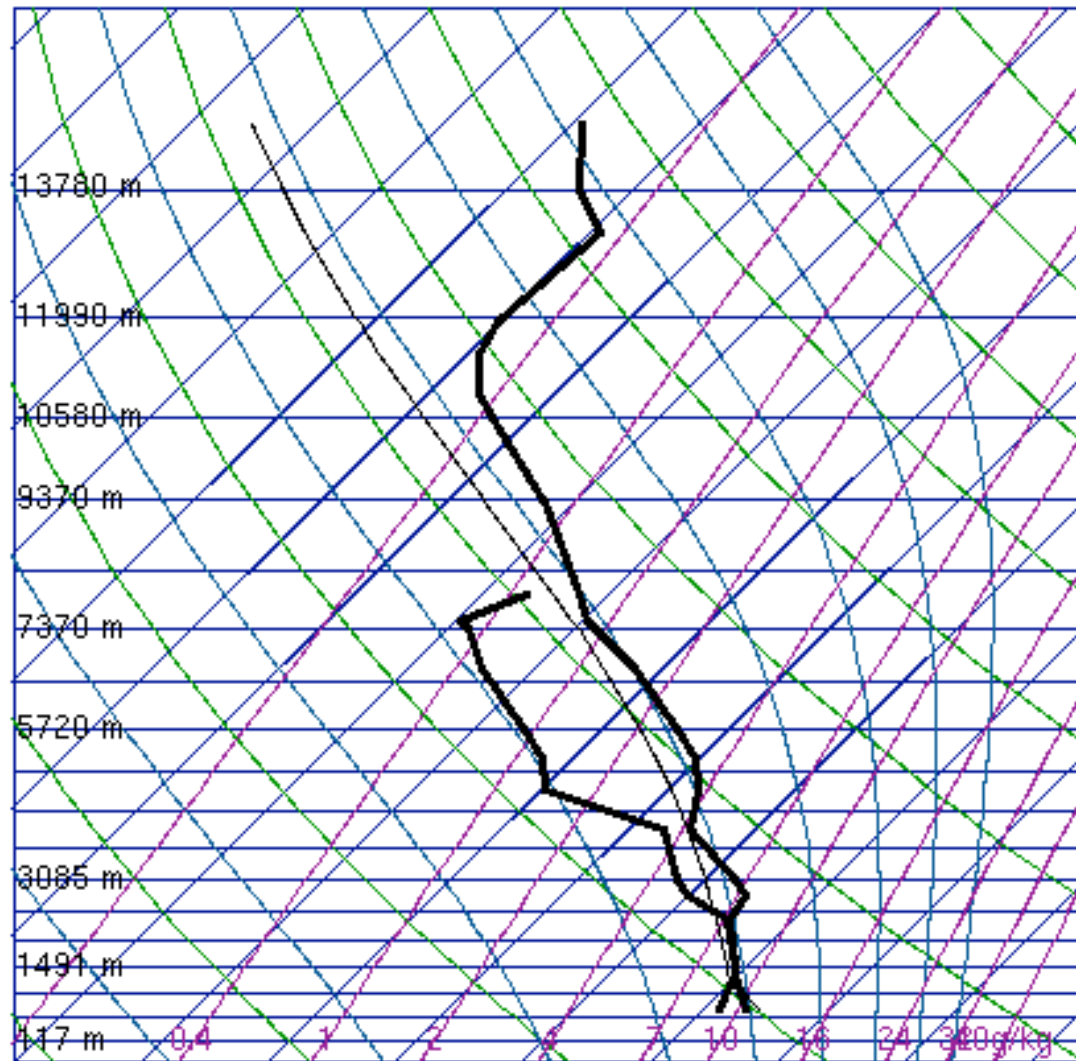
500

600

700

800

900



-40 -30 -20 -10 0 10 20 30 40



SLAT 34.90
SLON -117.87
SELV 702.0
SHOW 1.79
LIFT 2.70
LFTV 2.53
SWET 332.2
KINX 28.00
CTOT 23.30
VTOT 23.30
TOTL 46.60
CAPE 0.00
CAPV 0.00
CINS 0.00
CINV 0.00
EQLV -9999
EQTV -9999
LFCT -9999
LFCV -9999
BRCH 0.00
BRCV 0.00
LCLT 283.5
LCLP 887.9
MLTH 293.4
MLMR 9.02
THCK 5603.
PWAT 24.35

12Z 19 Feb 1986

University of Wyoming

Prev

Next

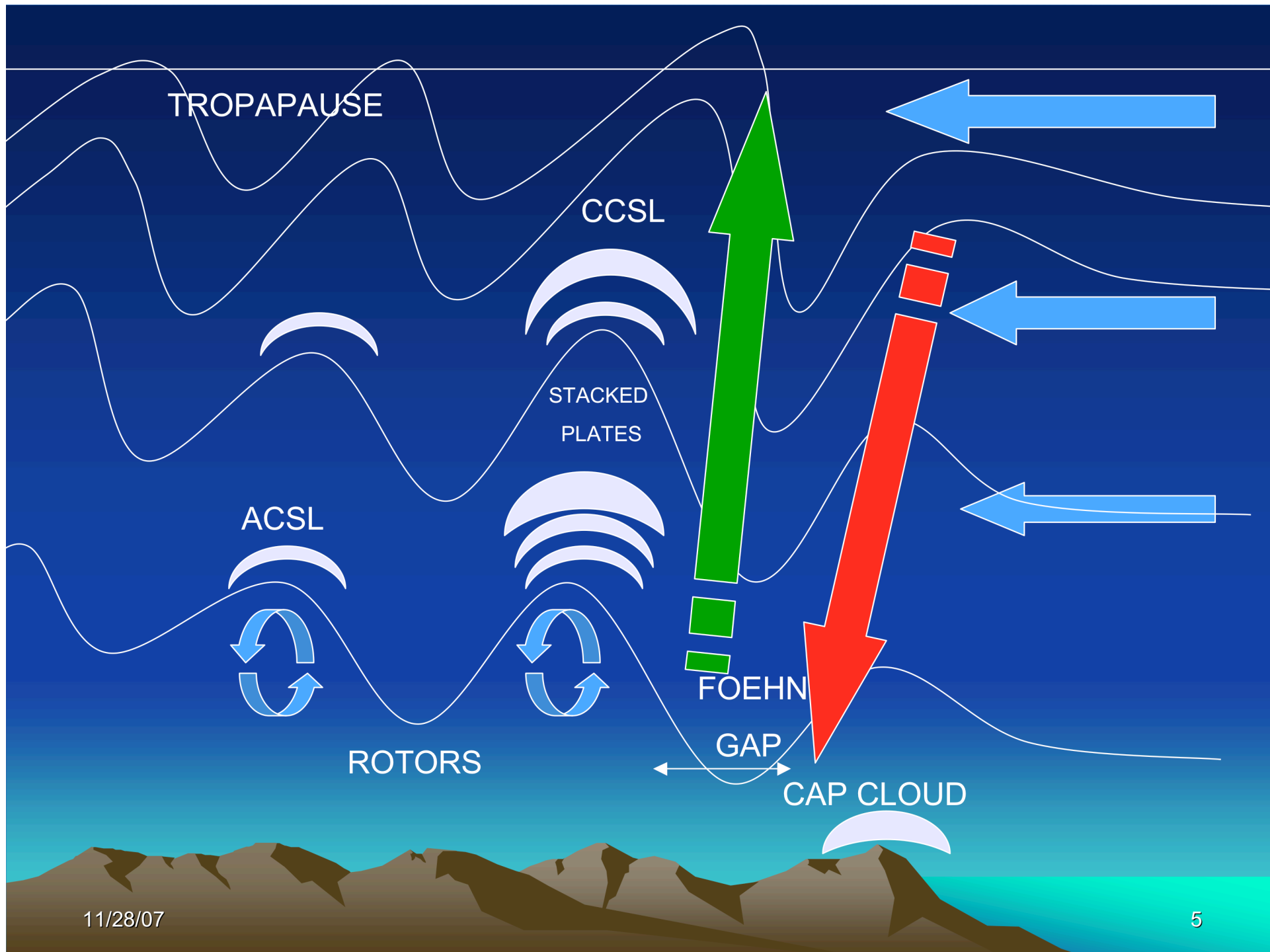
Stop

Start

Slower

Faster

Delete





NOAA's National Weather Service Aviation Weather Center Aviation Digital Data Service (ADDS)

weather.gov



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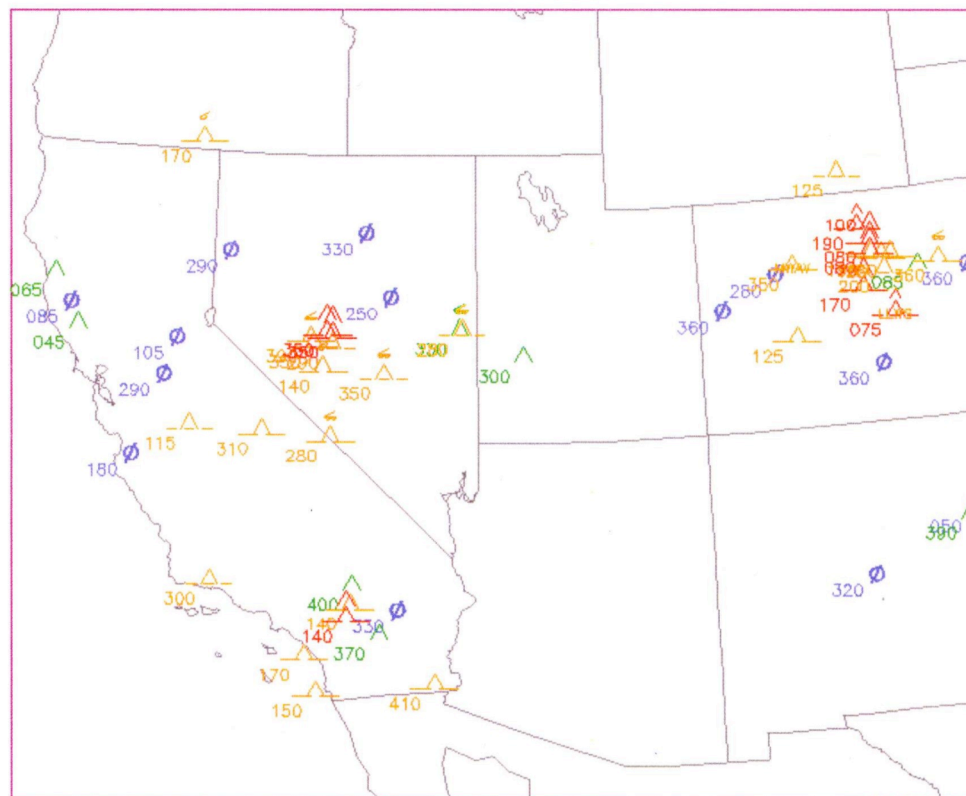
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USA.gov
Government Made Easy

Pilot Reports (PIREPs) of Turbulence

2220z - 2343z 11/27/07



TB FREQUENCY:
 ◉ = ISOLATED
 ◉ = INTERMITTENT
 ◉ = CONTINUOUS
 ◉ = NEG
 ◉ = LGT
 ◉ = MOD
 ◉ = SEV
 ◉ = EXTRM
 --- SMOOTH-LGT
 --- LGT-MOD
 --- MOD-SEV

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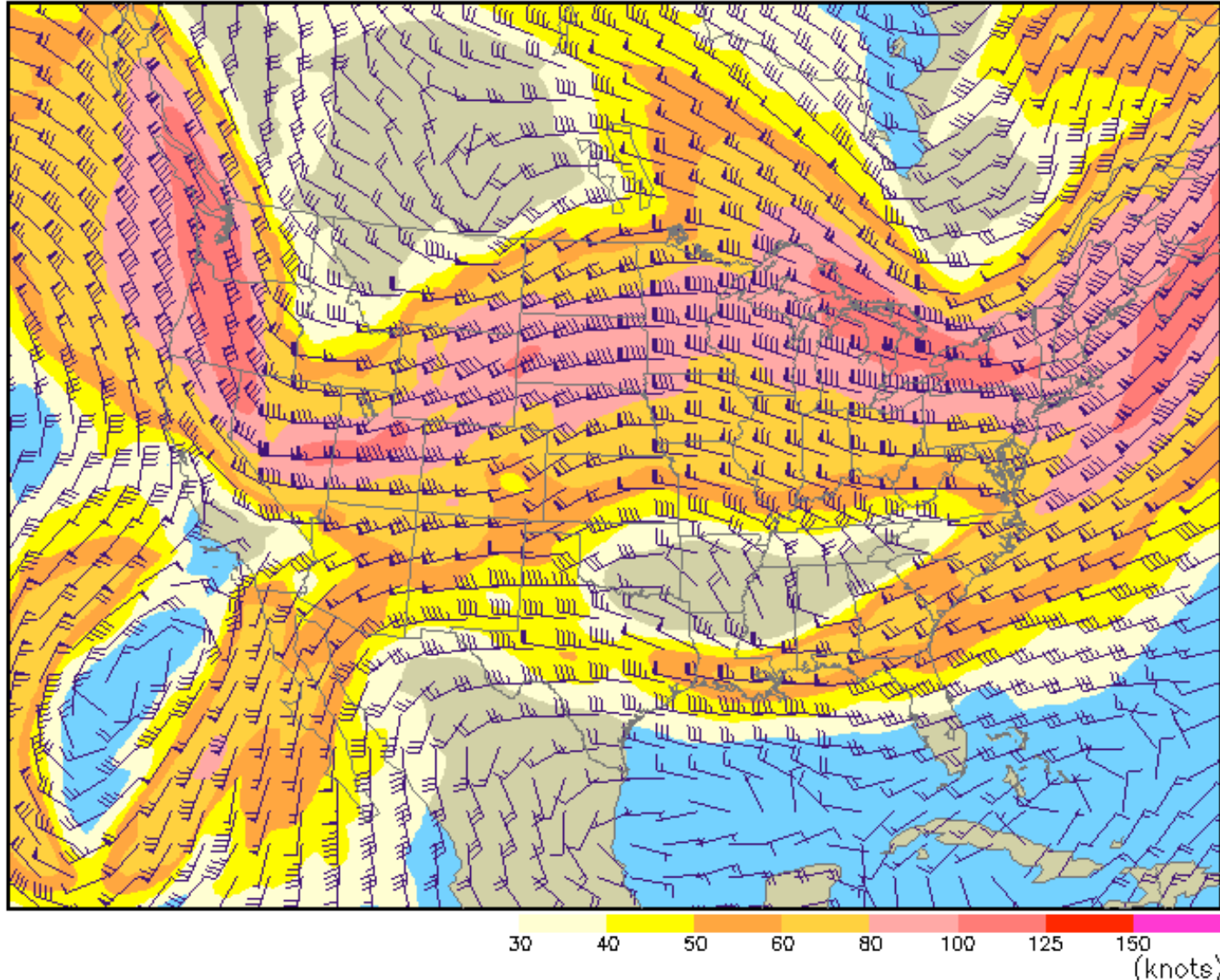
ADDs winds FL240

↓ ↑ FL240 2300 UTC Tue 27 Nov 2007 < >

Temperature Temperature difference
Wind speed Wind streamlines

Wind speed (kts) at 24,000 ft MSL (400 mb)

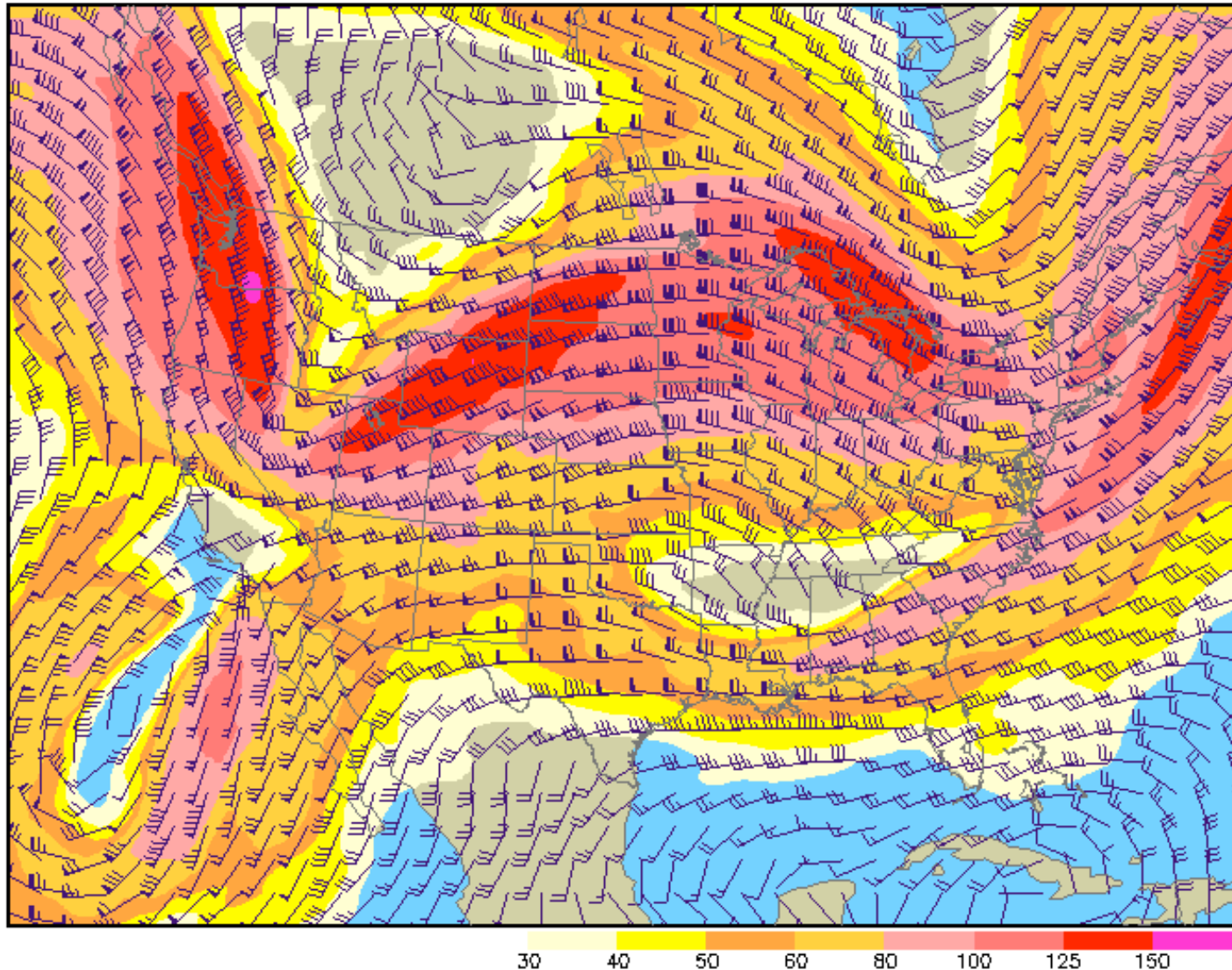
Analysis valid 2300 UTC Tue 27 Nov 2007



ADDs winds FL300

↓ ↑ FL300 2300 UTC Tue 27 Nov 2007 < >
Temperature Temperature difference
Wind speed Wind streamlines
Wind speed (kts) at 30,000 ft MSL (300 mb)

Analysis valid 2300 UTC Tue 27 Nov 2007



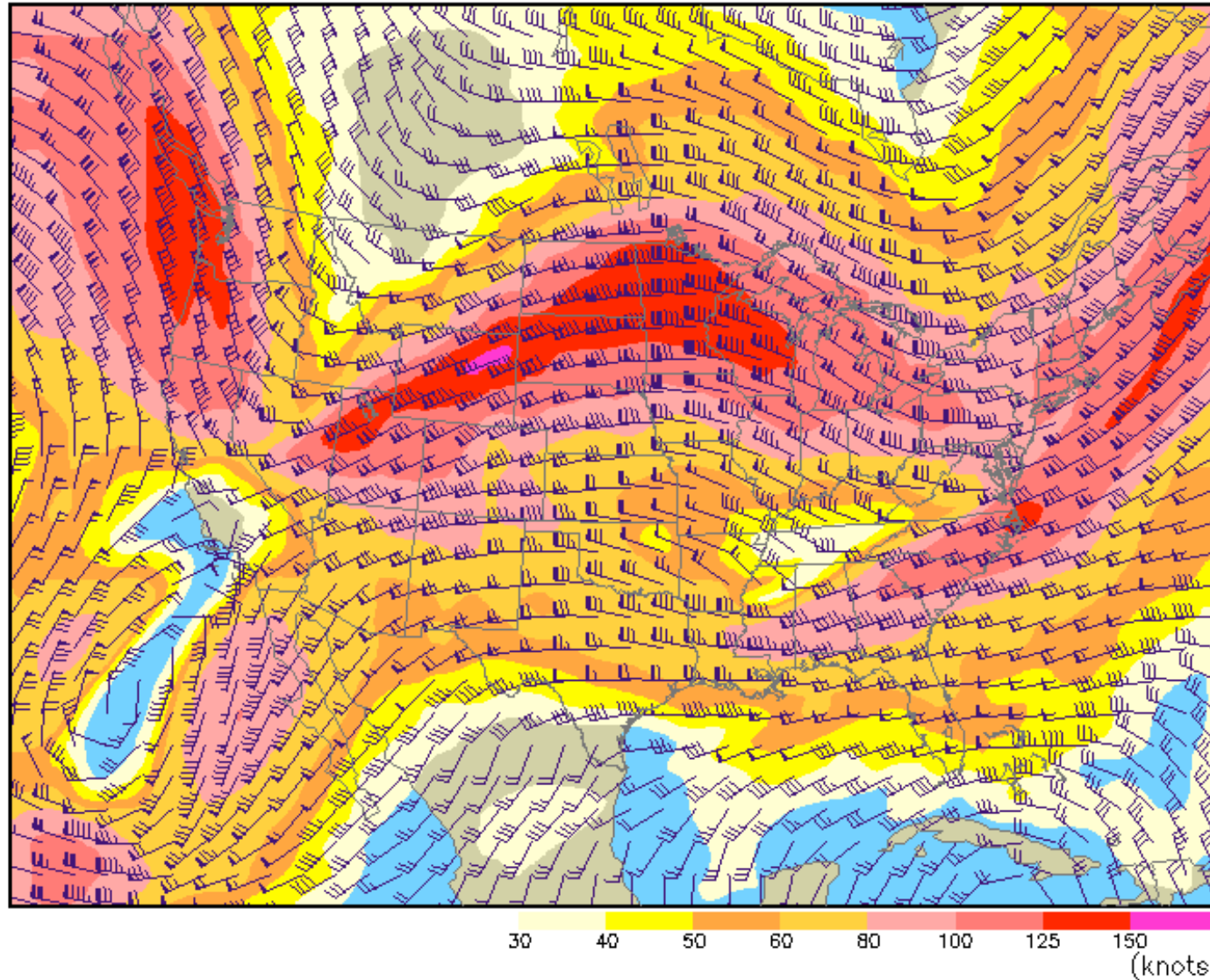
ADDs winds FL360

↓ ↑ FL360 2300 UTC Tue 27 Nov 2007 < >

☐ Temperature ☐ Temperature difference
☒ Wind speed ☐ Wind streamlines

Wind speed (kts) at 36,000 ft MSL (225 mb)

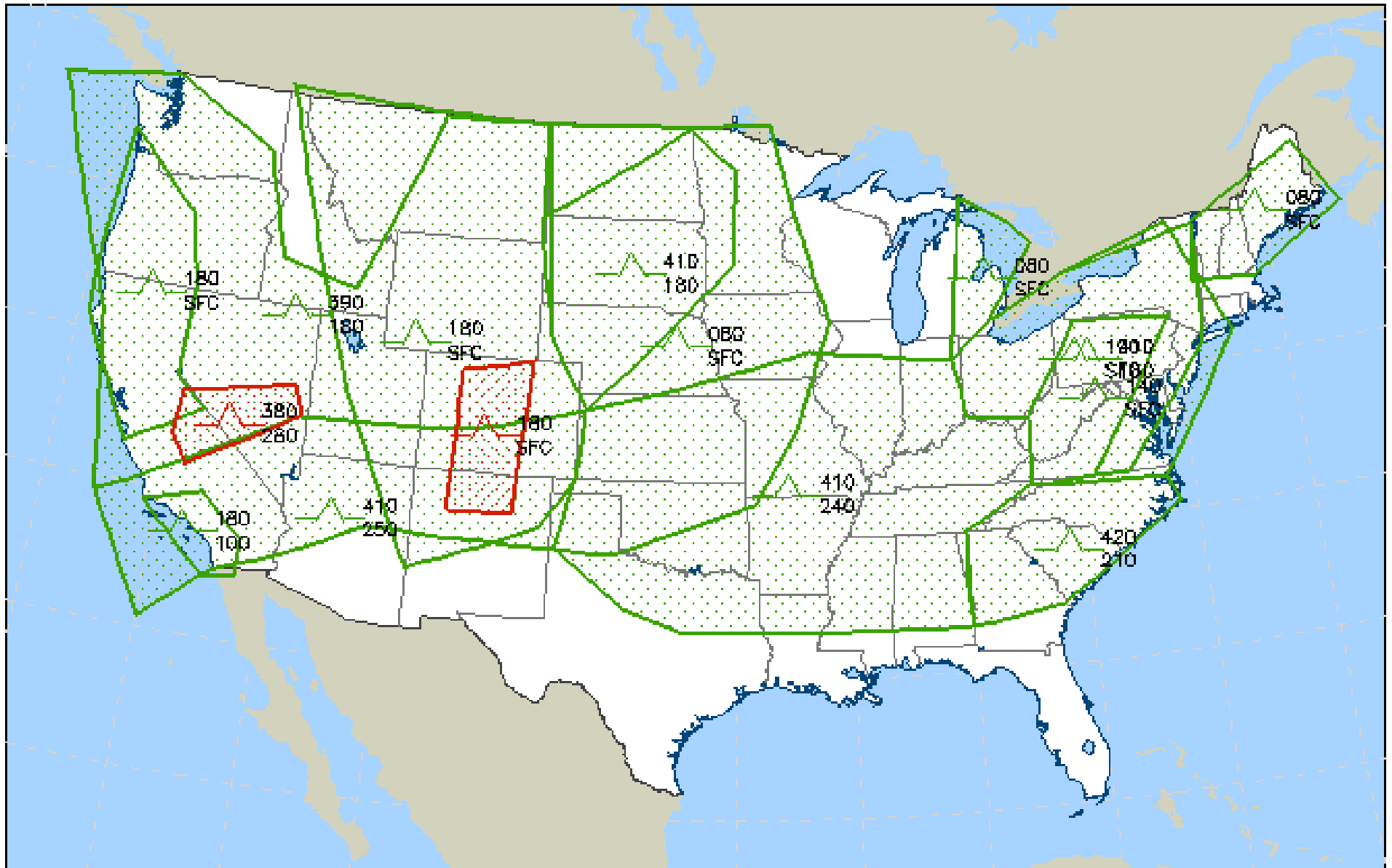
Analysis valid 2300 UTC Tue 27 Nov 2007



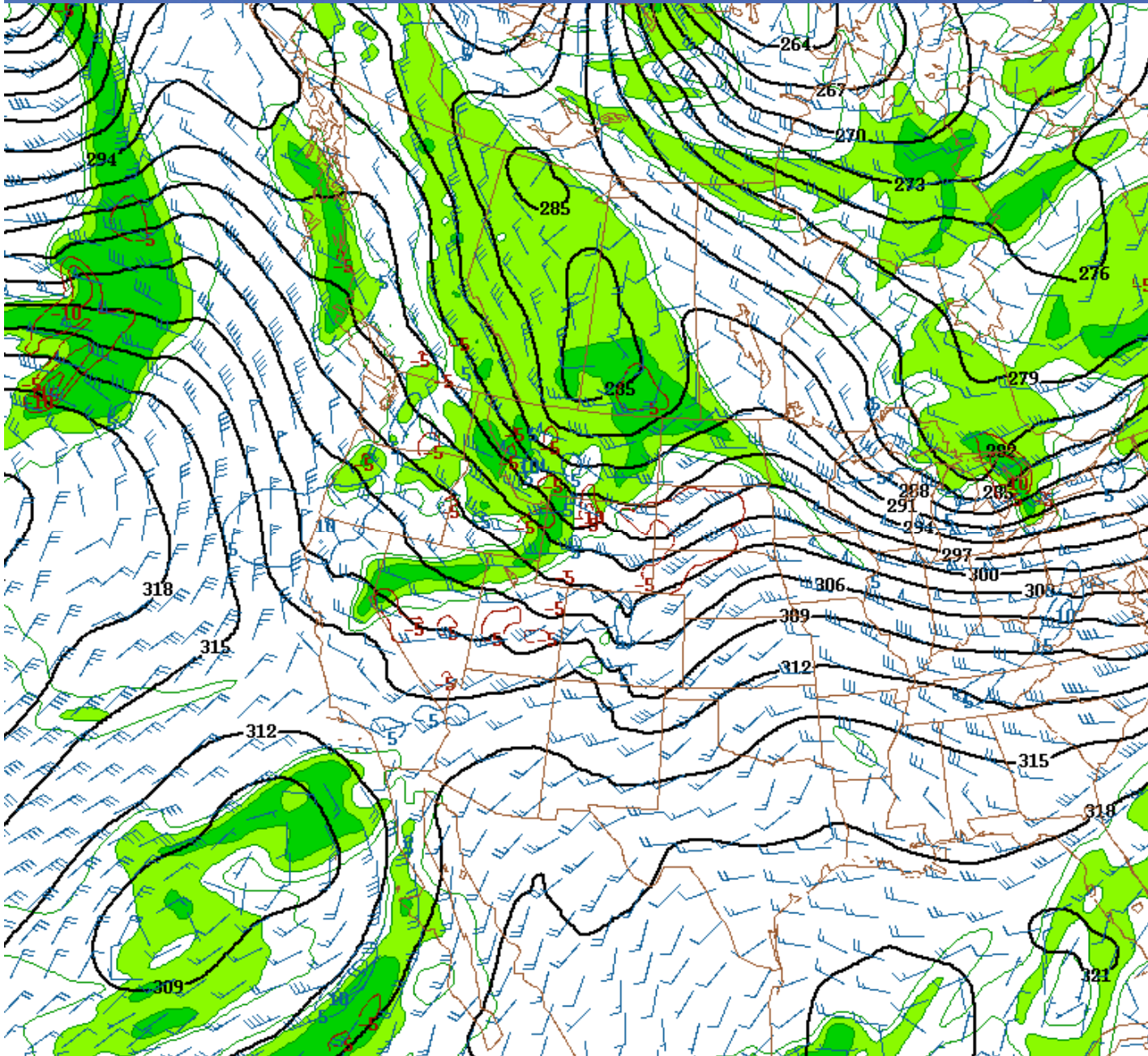
Turbulence AIRMETs (green) and SIGMETs (red)

chart created at 2255 UTC Tue 27 Nov 2007

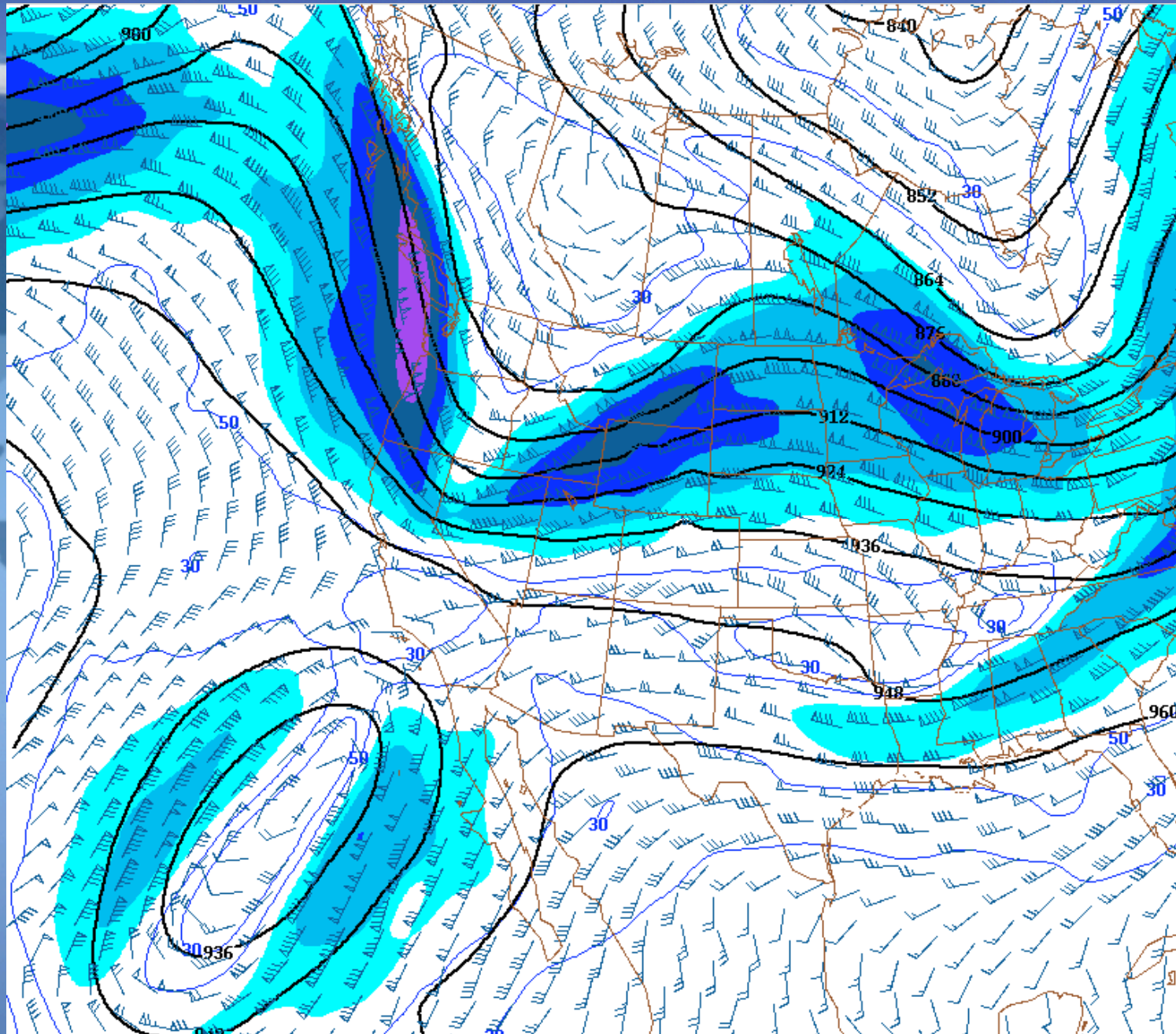
AIRMETs valid until 0300z/28th, SIGMETs expire at or before 0215z/28th



WIND/MB FL100



200mb/FL350



72387 DRA Mercury

100

200

300

400

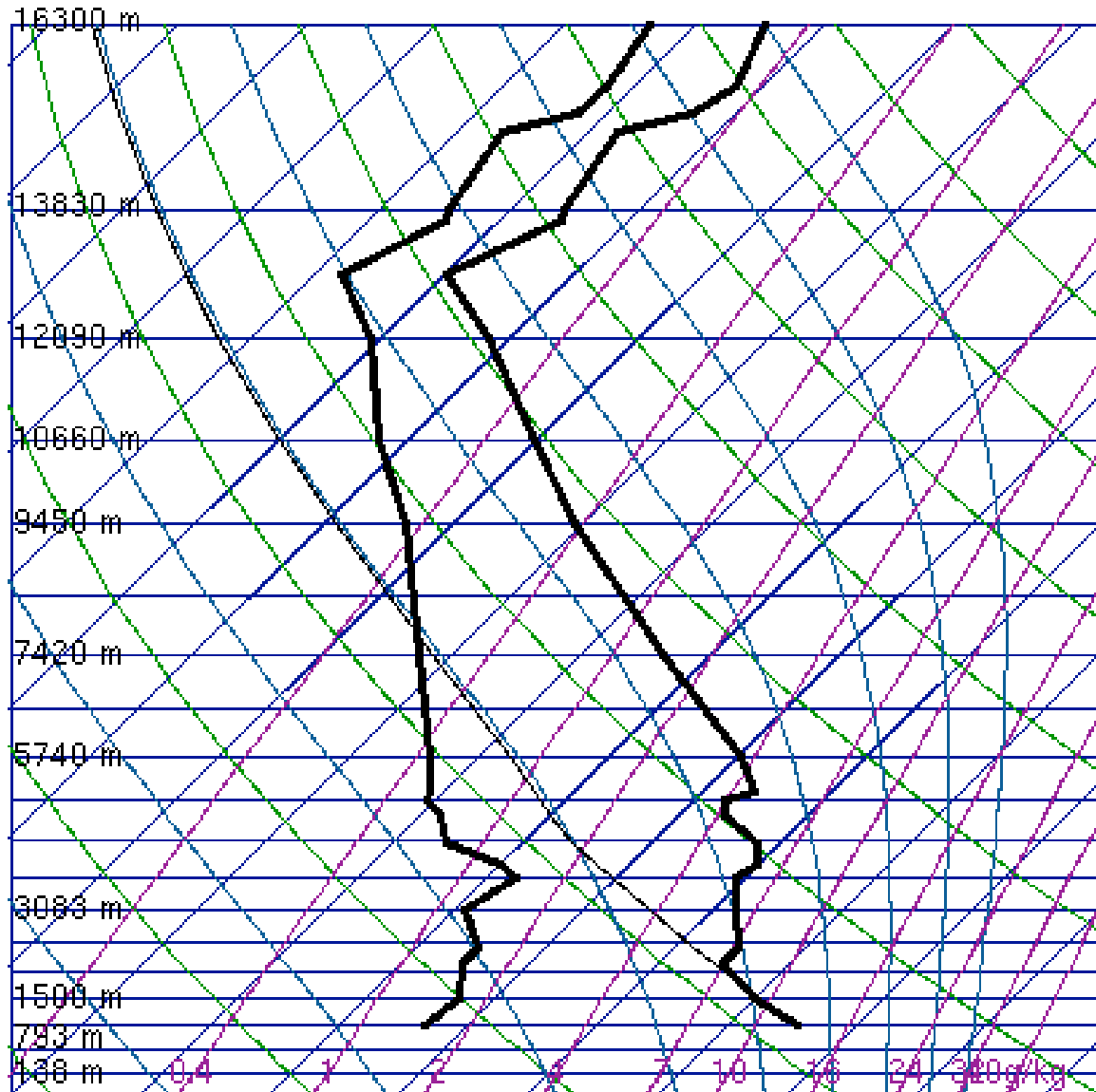
500

600

700

800

900

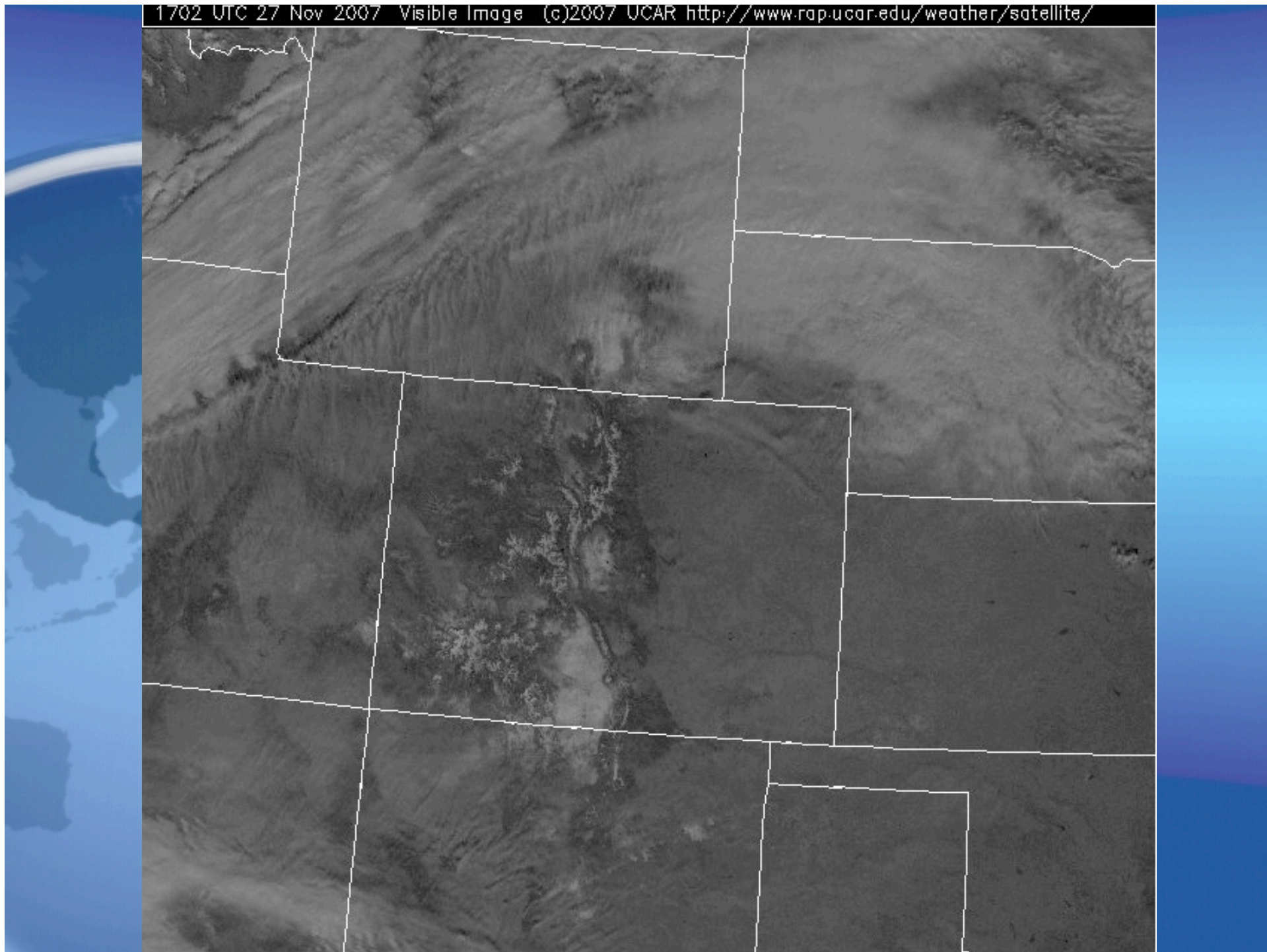


SLAT 36.61
SLON -116.01
SELV 1009.
SHOW 17.76
LIFT 17.75
LFTV 17.70
SWET 92.99
KINX -13.9
CTOT -3.10
VTOT 19.90
TOTL 16.80
CAPE 0.00
CAPV 0.00
CINS 0.00
CINV 0.00
EQLV -9999
EQTV -9999
LFCT -9999
LFCV -9999
BRCH 0.00
BRCV 0.00
LCLT 255.2
LCLP 587.5
MLTH 297.1
MLMR 1.60
THCK 5602.
PWAT 5.61

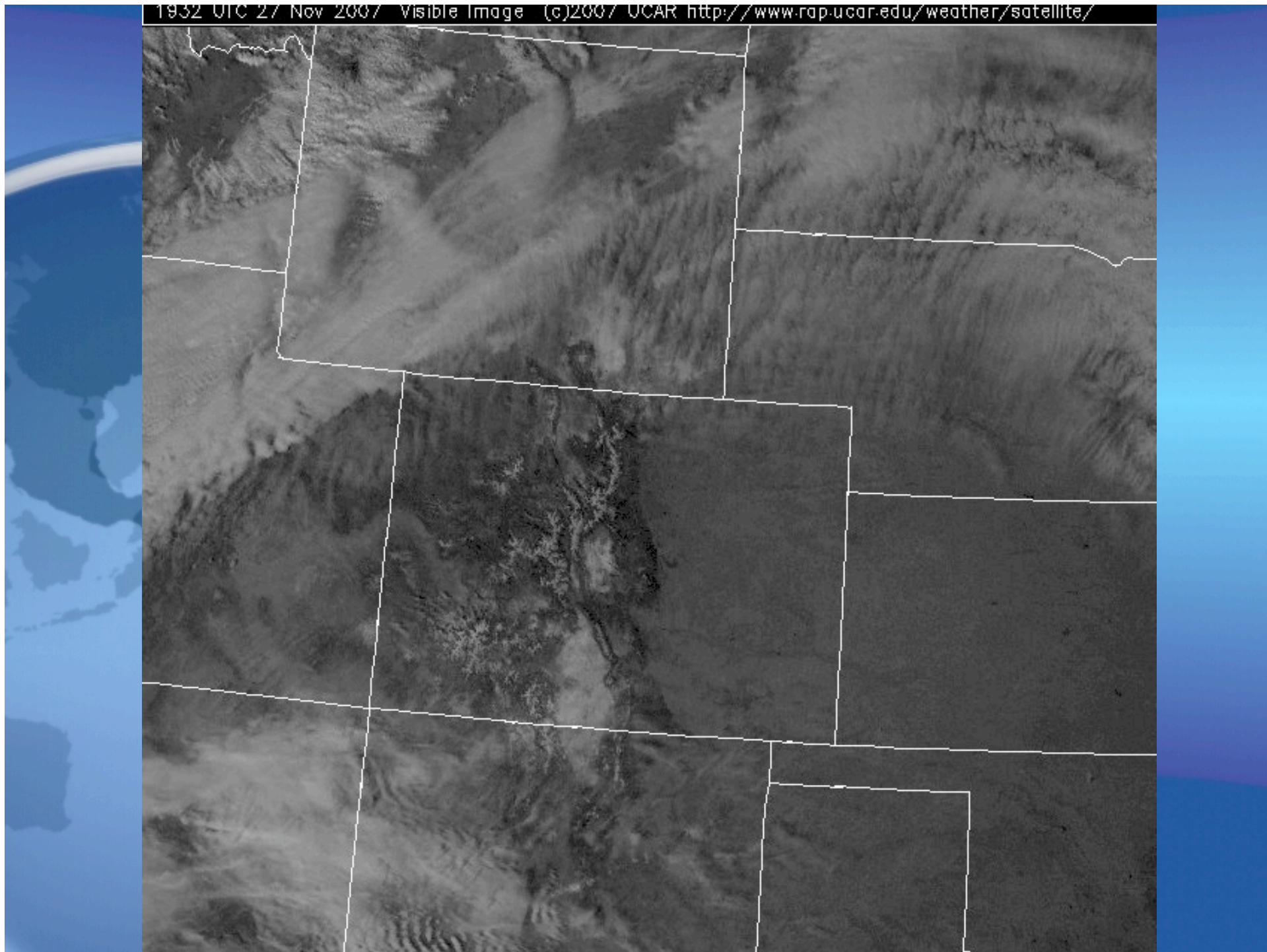
00Z 28 Nov 2007

University of Wyoming

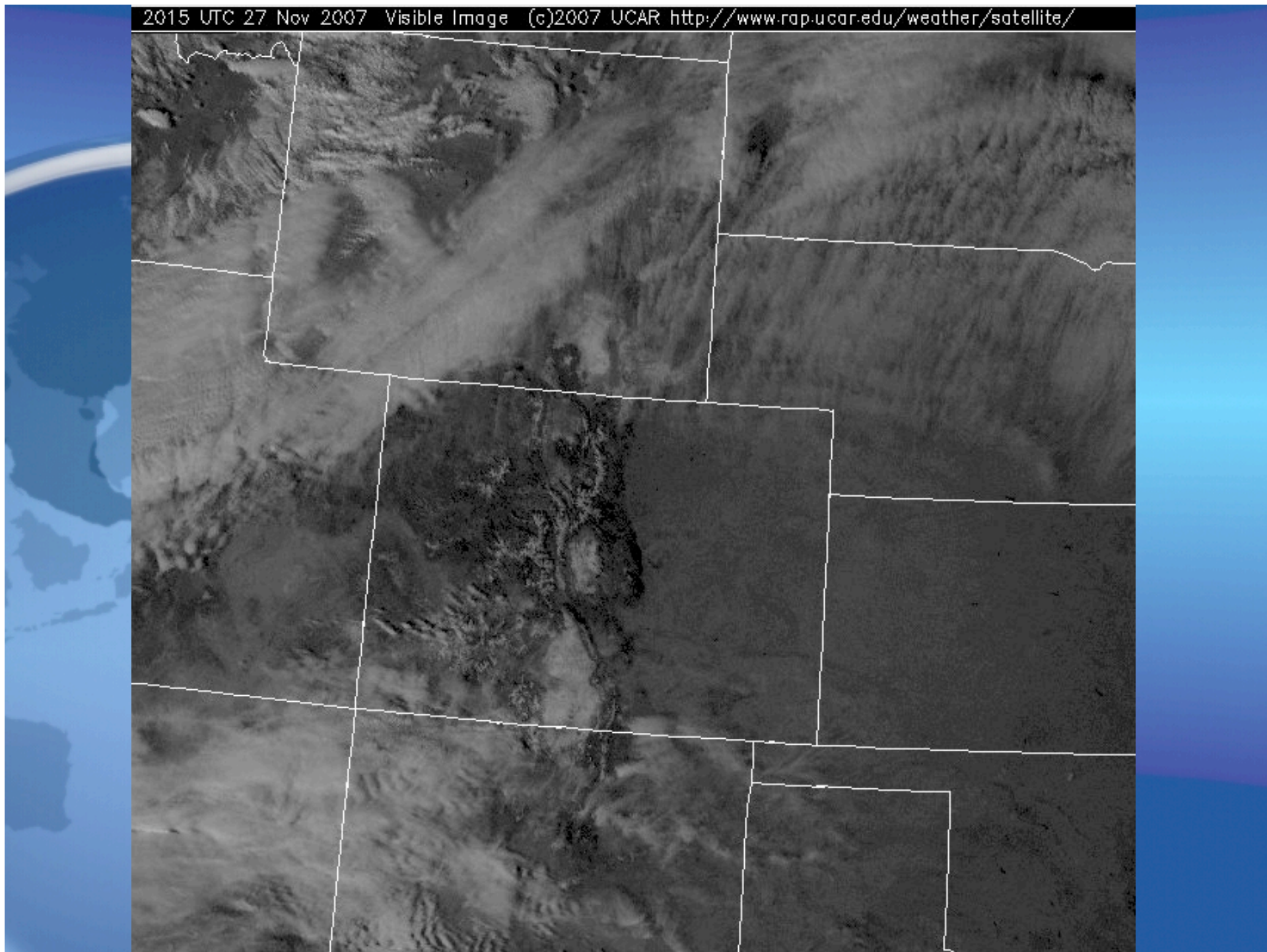
1702 UTC 27 Nov 2007 Visible Image (c)2007 UCAR <http://www.rap.ucar.edu/weather/satellite/>



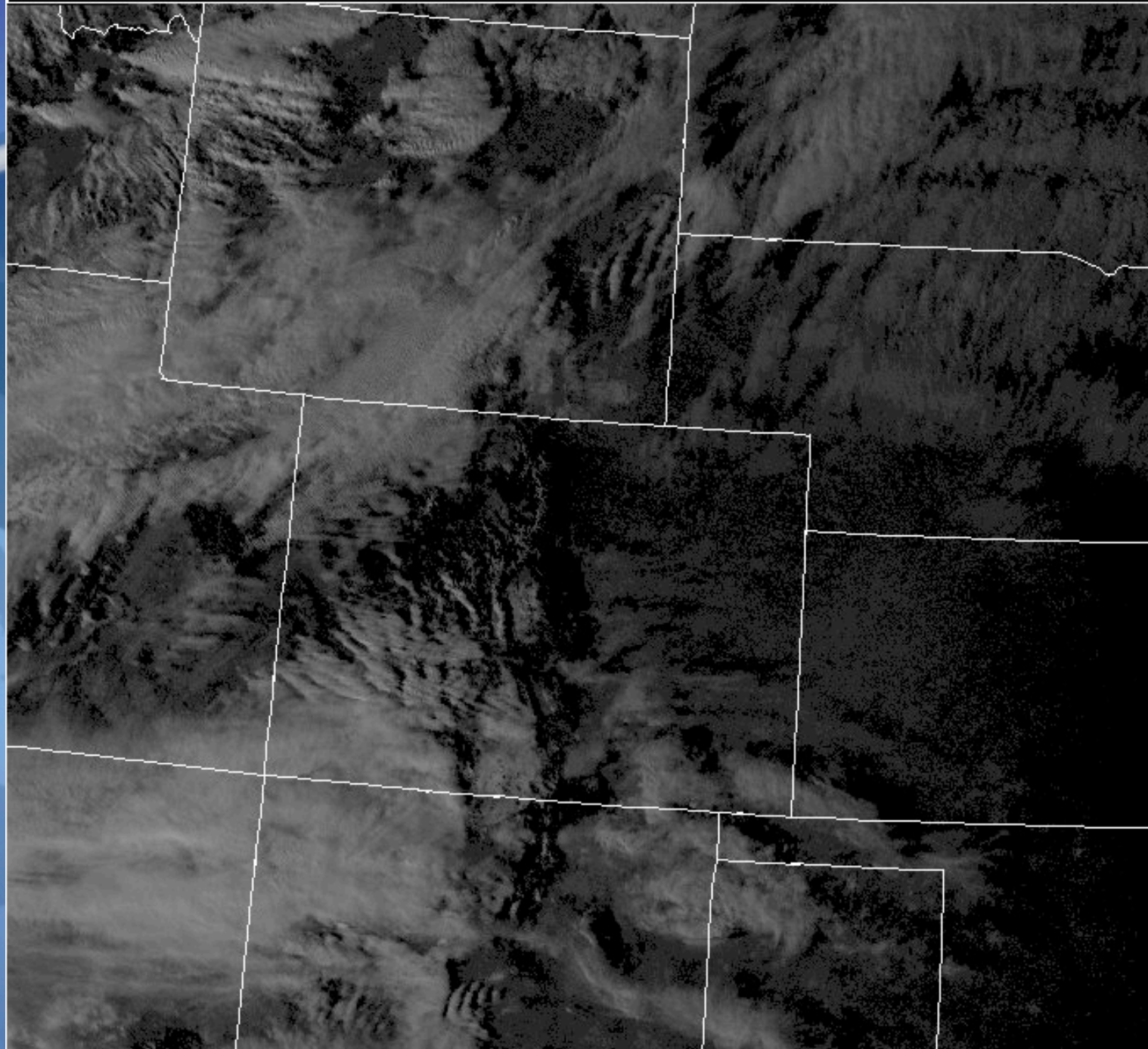
1932 UTC 27 Nov 2007 Visible Image (c)2007 UCAR <http://www.rap.ucar.edu/weather/satellite/>



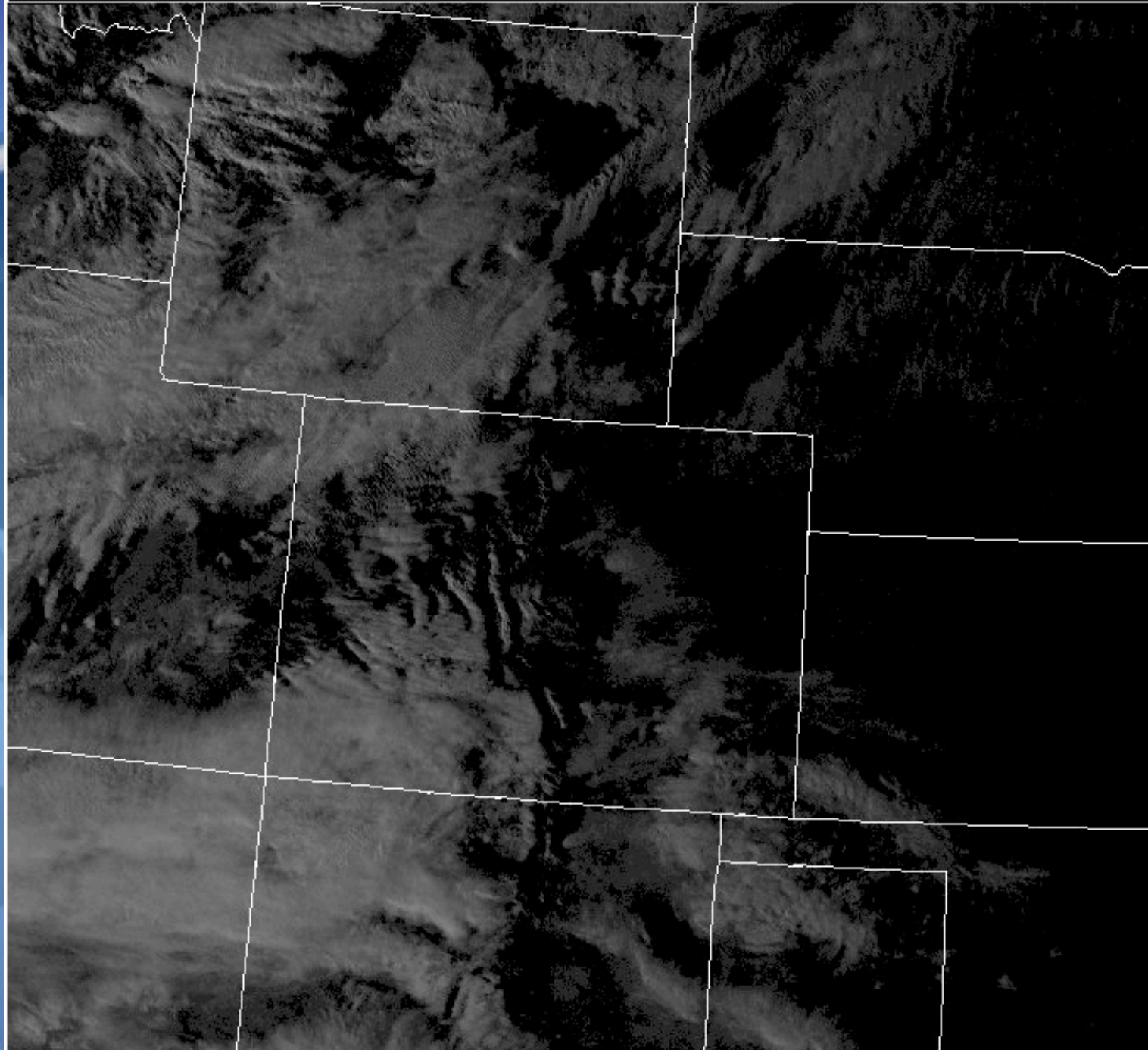
2015 UTC 27 Nov 2007 Visible Image (c)2007 UCAR <http://www.rap.ucar.edu/weather/satellite/>



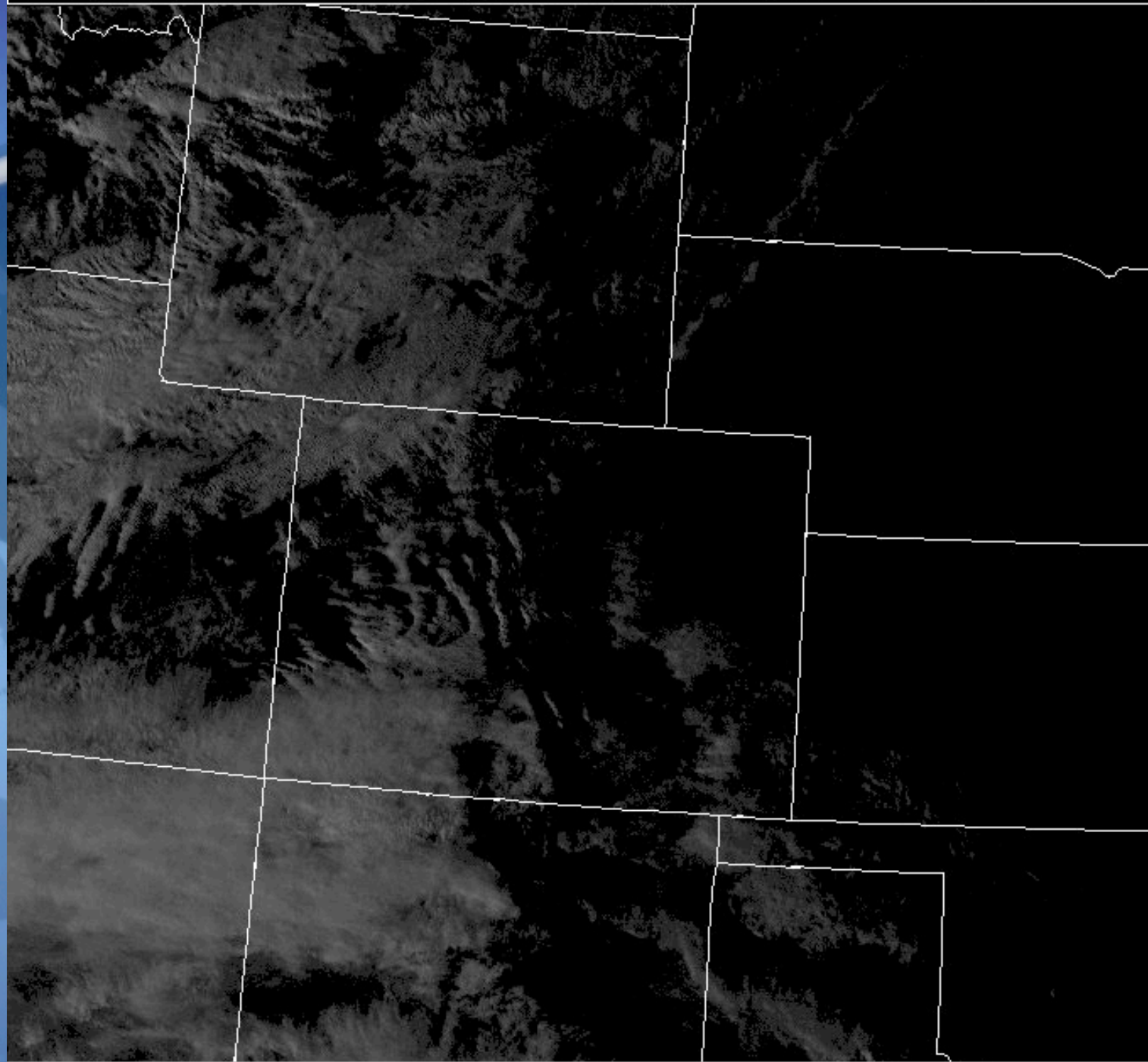
2145 UTC 27 Nov 2007 Visible Image (c)2007 UCAR <http://www.rap.ucar.edu/weather/satellite/>



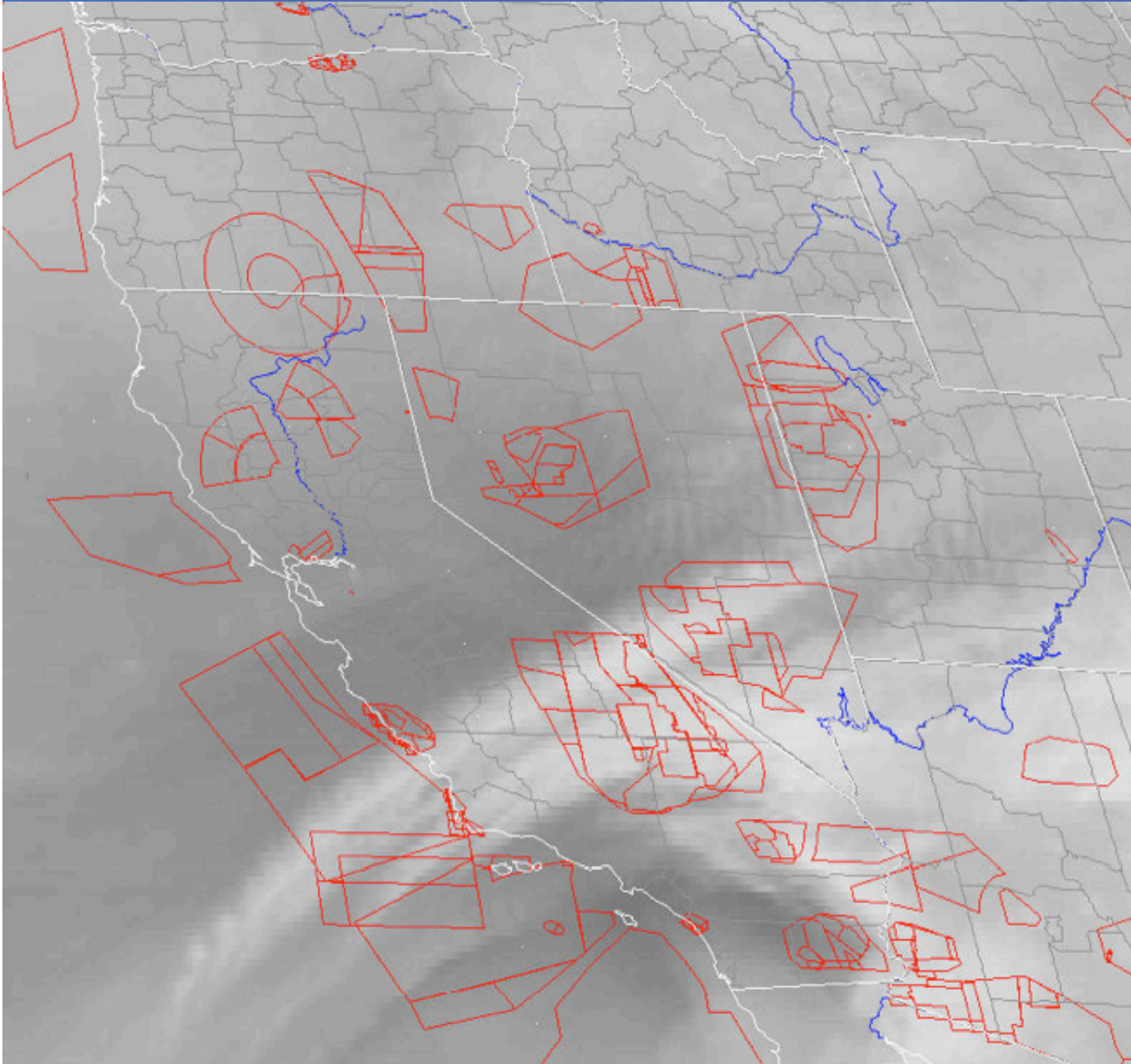
2215 UTC 27 Nov 2007 Visible Image (c)2007 UCAR <http://www.rap.ucar.edu/weather/satellite/>



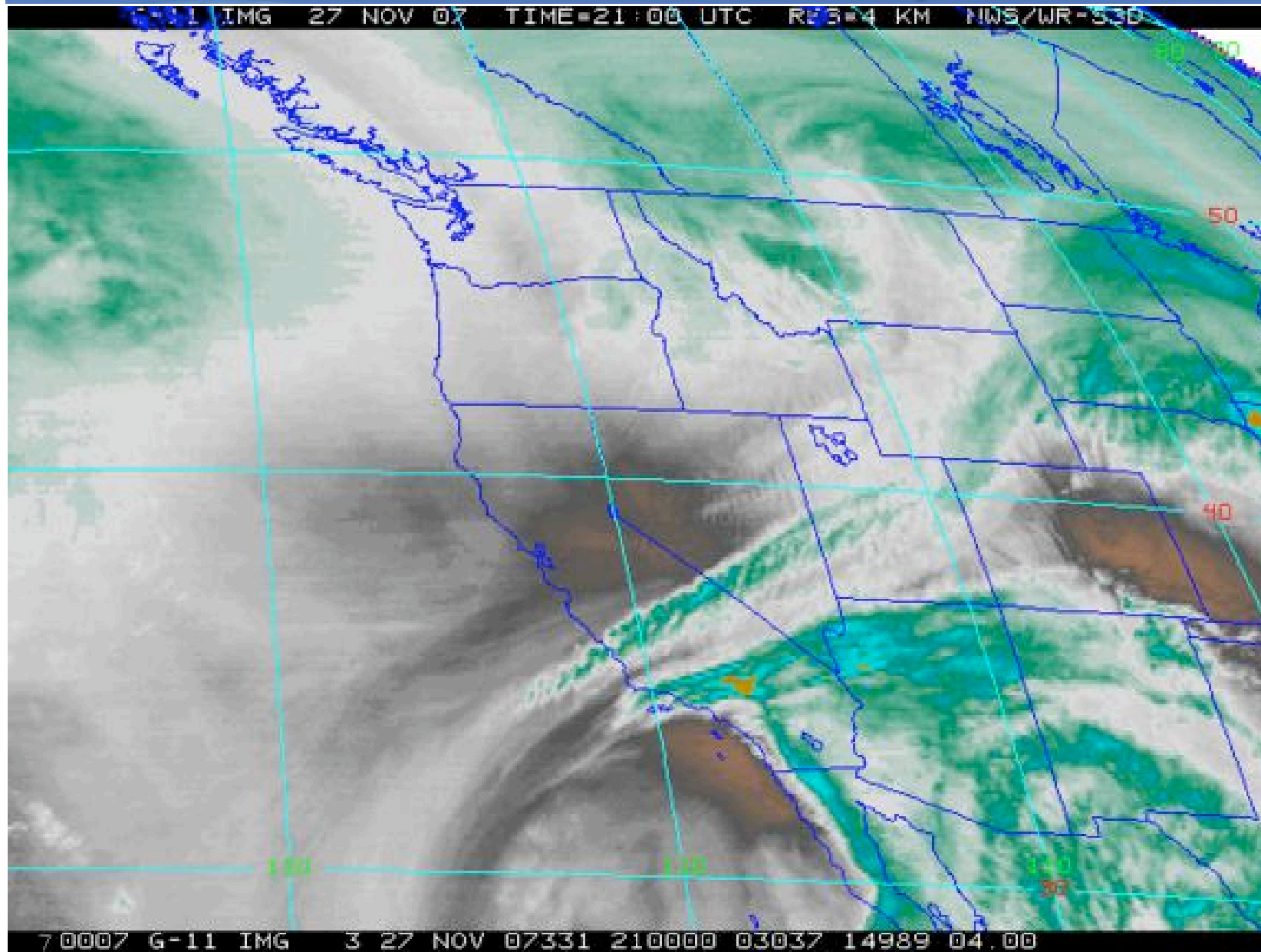
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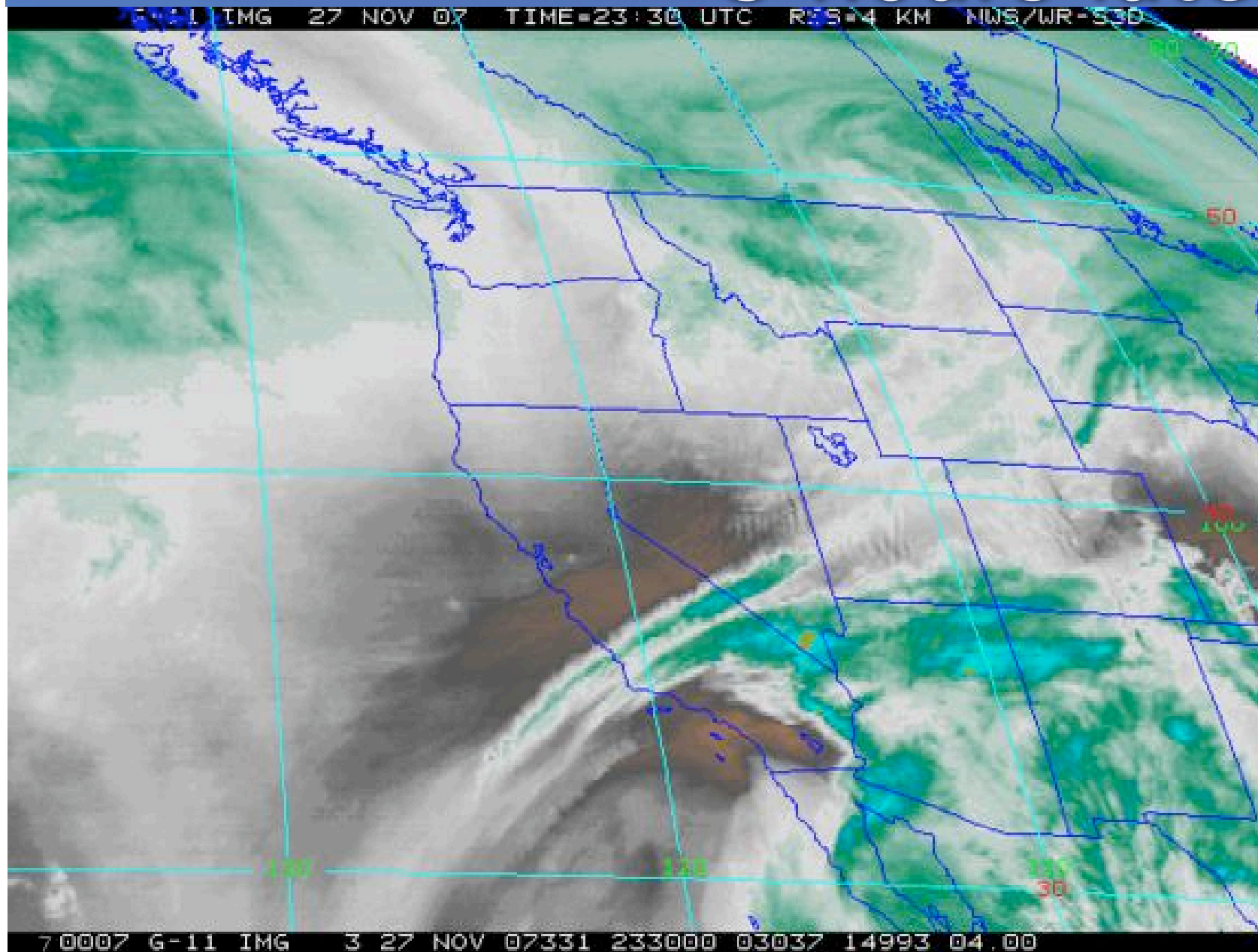
Water vapor satellite picture



Water vapor w US



3 hours later...



VAUS45 KPCI 272220 AAC
SLCT WA 272220 AMD
AIRMET TANGO UPDT 6 FOR TURB VALID UNTIL 280300
AIRMET TURB...ID MT WY UT CO AZ NM..UPDT
FROM 50WSW YXC TO 50NNW ISN TO BFF TO GLD TO 50W LBL TO TCC TO
50S SJN TO DTA TO 50WSW YXC
MOD TURB BLW FL180. CONDS ENDG 00-03Z.

VAUS45 KPCI 272220 AAC
SLCT WA 272220 AMD
AIRMET TANGO UPDT 6 FOR TURB VALID UNTIL 280300
AIRMET TURB...NV UT CO AZ NM CA AND CSTL WTRS
FROM GLD TO 50W LBL TO TXO TO 20SSW INW TO 40NNE BZA TO 20S MZB
TO 200SW MZB TO 140SSW SNS TO ILC TO HBU TO GLD
MOD TURB BTN FL250 AND FL410. CONDS CONTGB BYD 03Z THRU 09Z.

VAUS45 KPCI 272220 AAC
SLCT WA 272220 AMD
AIRMET TANGO UPDT 6 FOR TURB VALID UNTIL 280300
AIRMET TURB...ID MT WY NV UT CO WA OR CA AND CSTL WTRS
FROM 50NNW ISN TO 70NW RAP TO BFF TO GLD TO HBU TO ILC TO 140SSW
SNS TO 20ESE FOT TO 140W TOU TO BLI TO 30S GEG TO BOI TO PIH TO
NONE HVR TO 50NNW ISN
MOD TURB BTN FL180 AND FL390. CONDS CONTG BYD 03Z ENDG NE PTN AND
PAR NW PTN 06-09Z. CONDS CONTG RMNDR THRU 09Z.

WSUS05 KPCI 272115
SLCN WS 272115
SIGMET NOVEMBER 1 VALID UNTIL 280115
SIGMET
CO NM
FROM 30ESE CYS TO 20E LVS TO 50NW ABQ TO CHE TO 30ESE CYS
CNL SEV TURB BLW FL180. RPRTD BY ACFT. CONDS CONTG BYD 0115Z.

WSUS05 KPCI 272215
SLCO WS 272215
SIGMET OSCAR 1 VALID UNTIL 280215
SIGMET
IV CA
FROM ELY TO ILC TO 30N EHF TO CZQ TO 60S FMG TO ELY
CNL SEV TURB BTN FL280 AND FL380. RPRTD BY ACFT. CONDS CONTG BYD
0215Z.

AIRMETs

SIGMETs

Thunderstorms



再生





ASK 21 Two Seat Glider

Figure 1

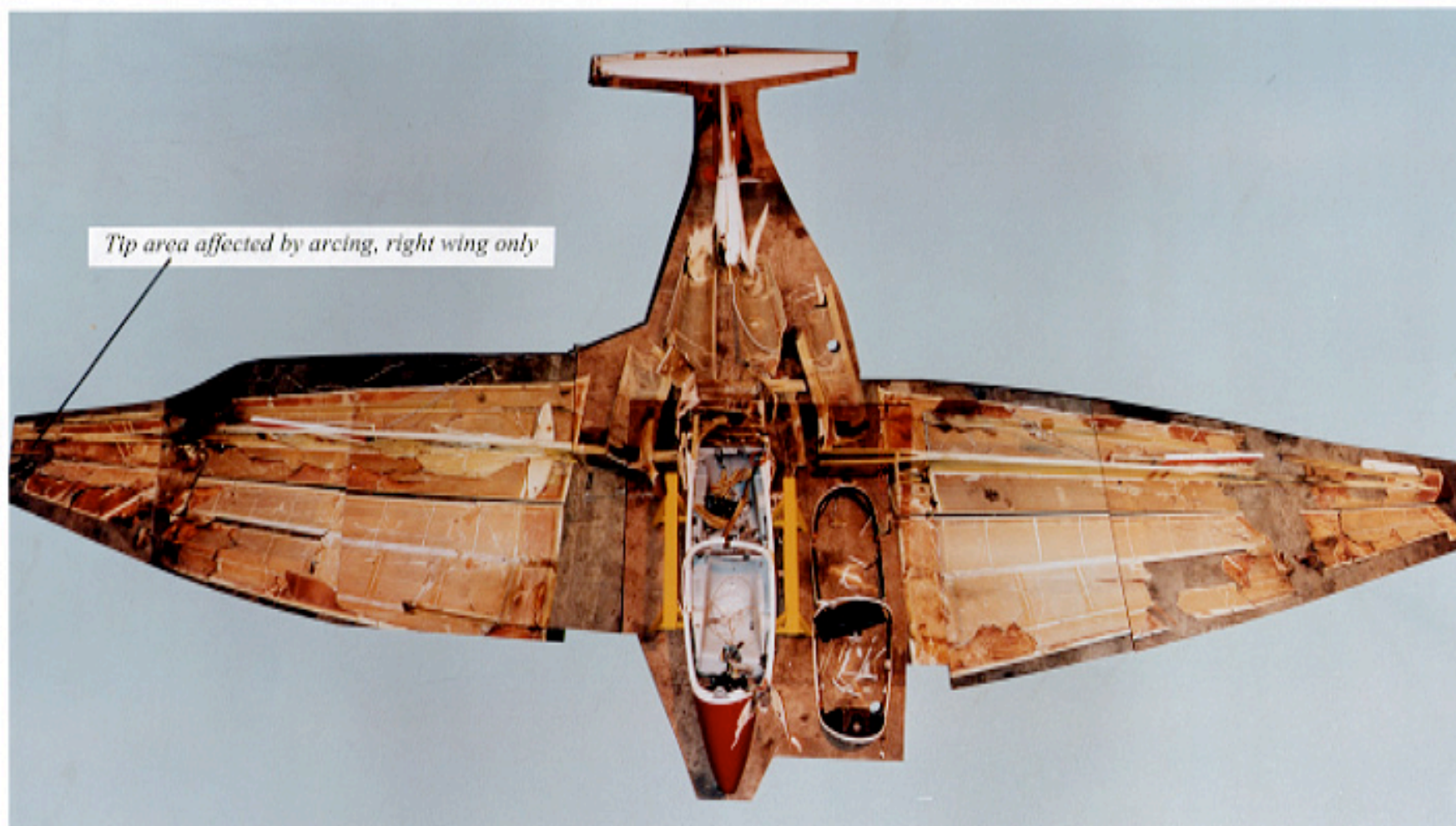
Manufactured in Germany by A Schleicher. Wing span 17m Max AUW = 1320 lbs



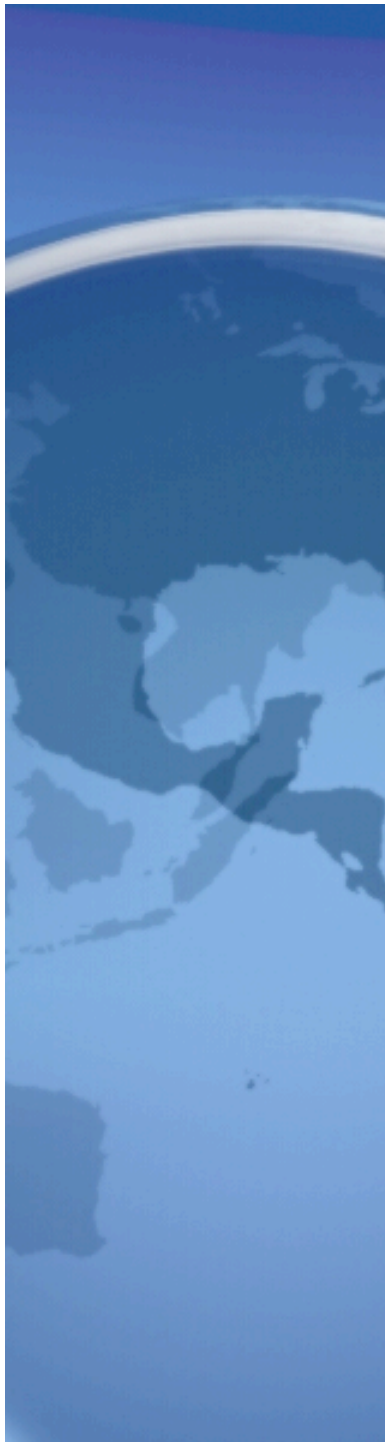
Wreckage of GBP

Cockpit and tail structures were relatively undamaged until impact with the ground

Figure 4



Composite view of structural layout



b

*Detail of right wing structure in region of aileron actuator rod/bellcrank**

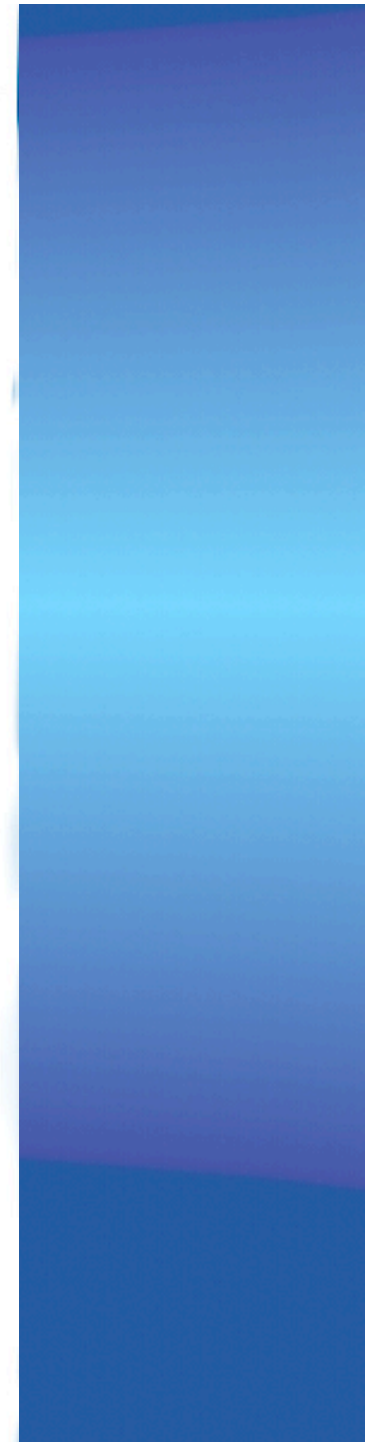


c

Upper surface (inverted)

LE

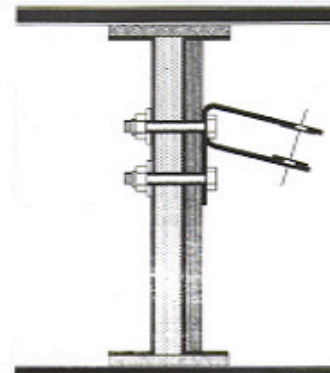
Lower surface



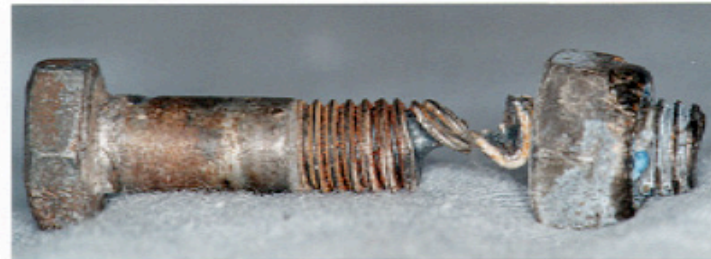


*Right aileron bellcrank mounting bracket
showing melted end and heat effects*

a



*Sketch of bracket attachment to spar
Two upper bolts, one lower*



Lower bolt failure

b



*Details of centre push rod from right wing
Rod is normally a tube of 16mm diameter, 1mm wall thickness*

c



d

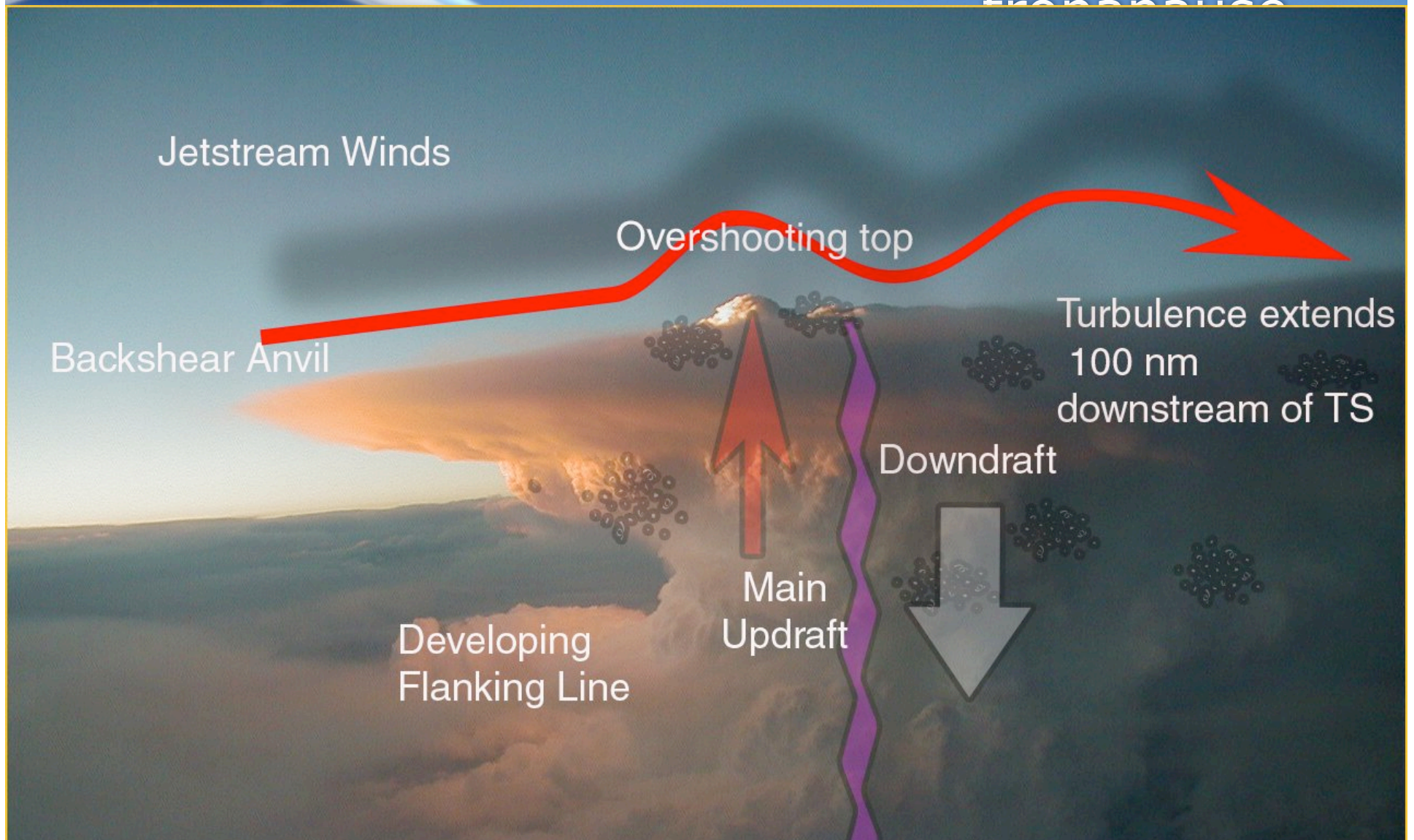


e

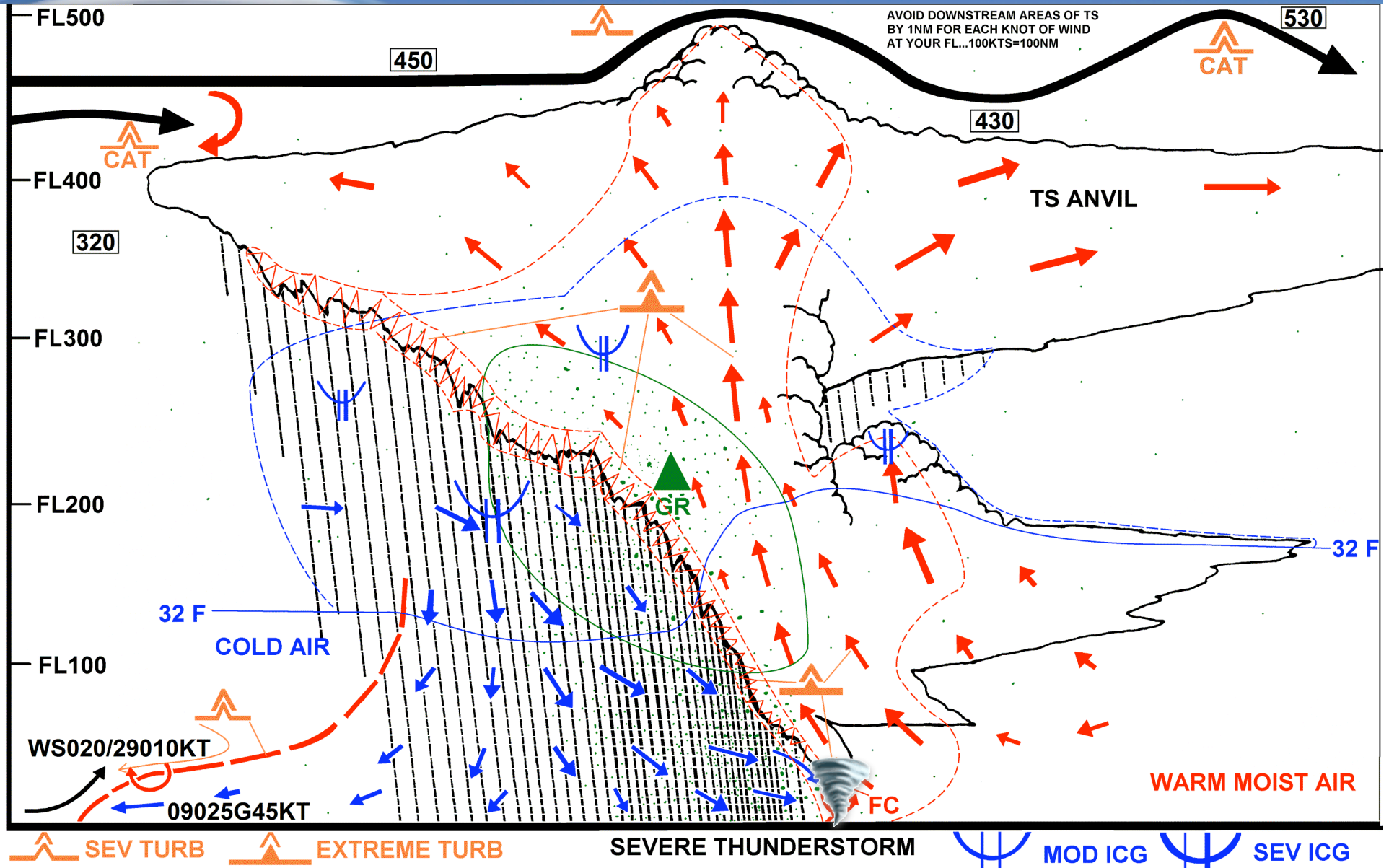
Figure 8

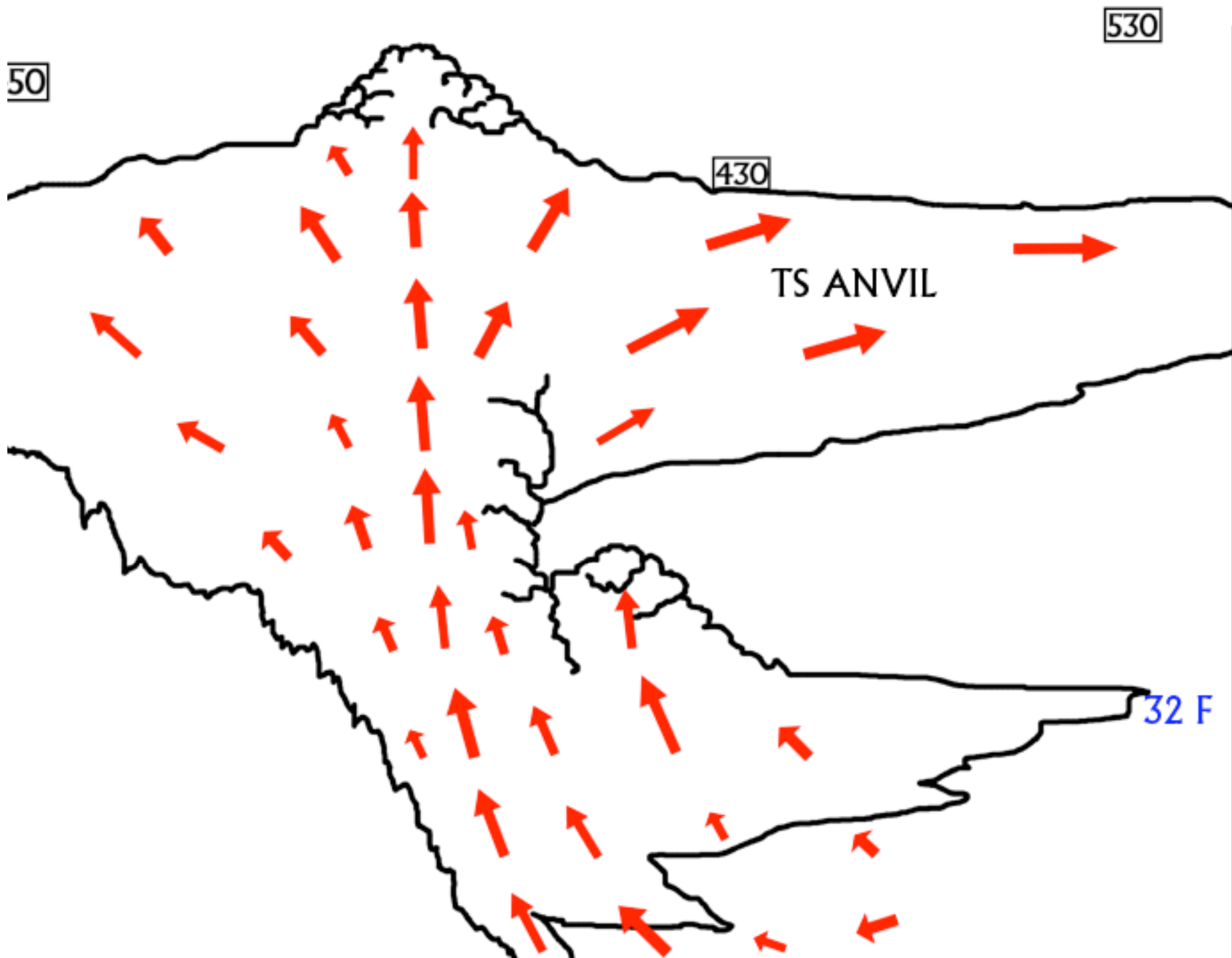


Southeast of a super cell TS near the tropopause



Super Cell TS diagram





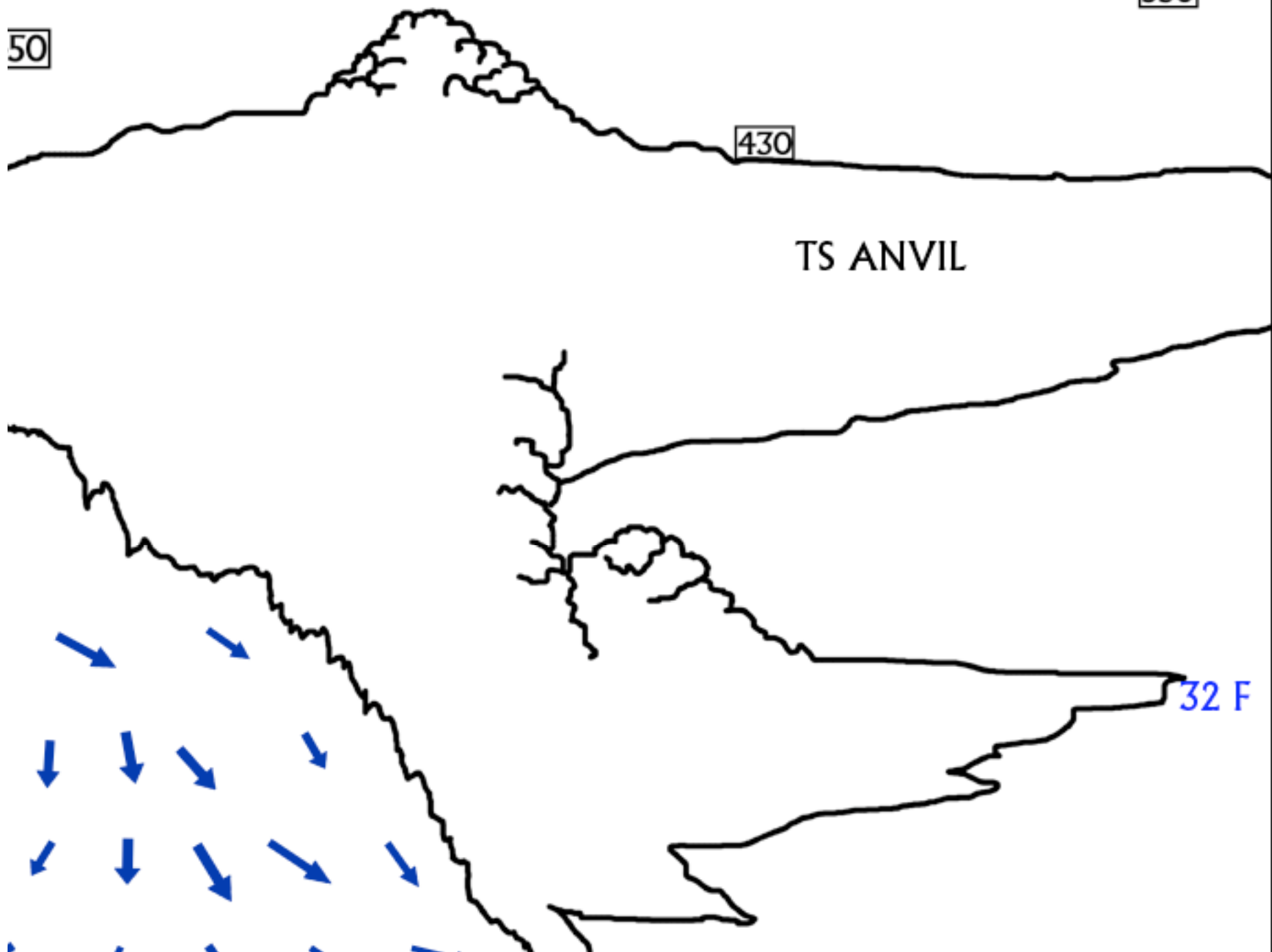
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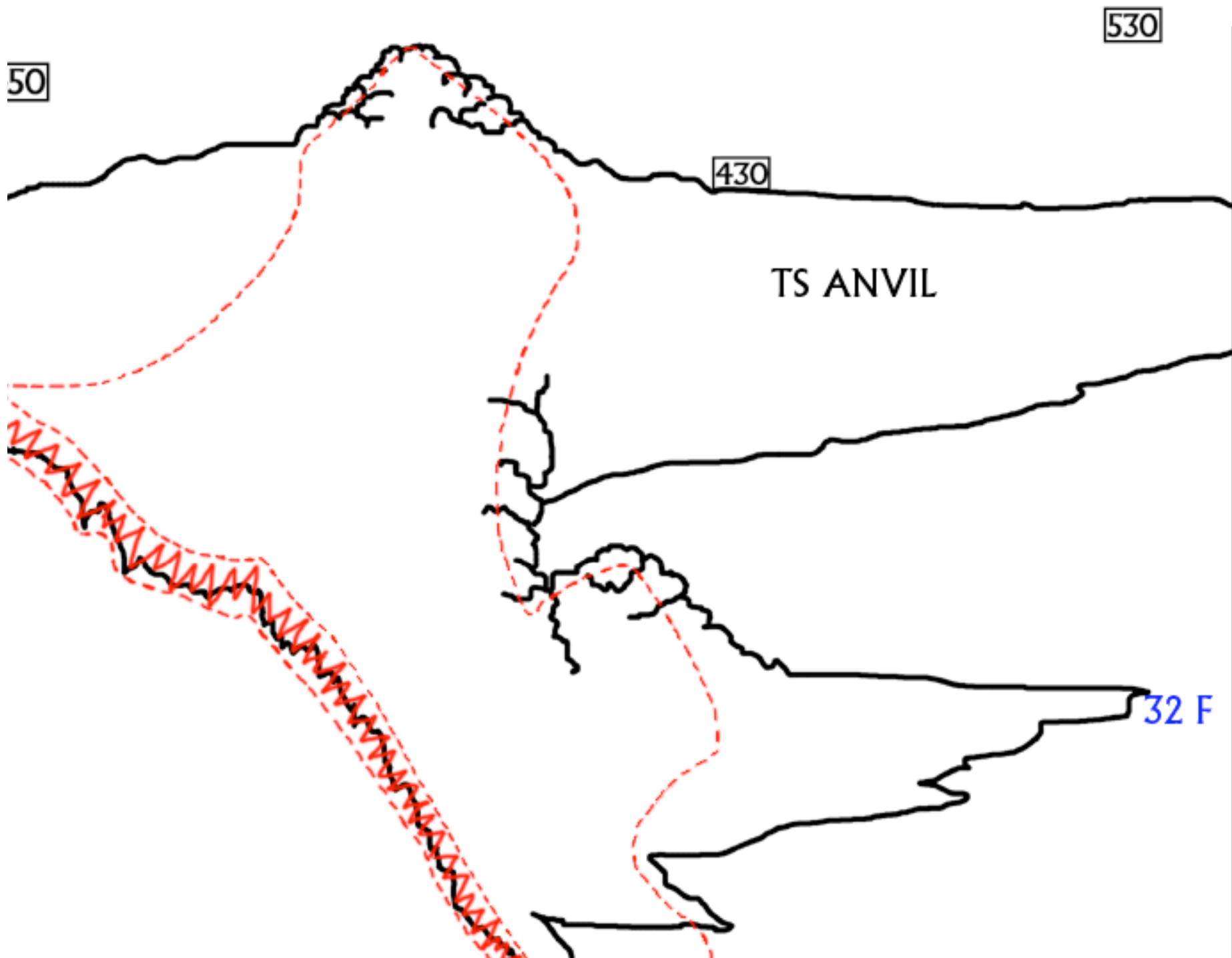
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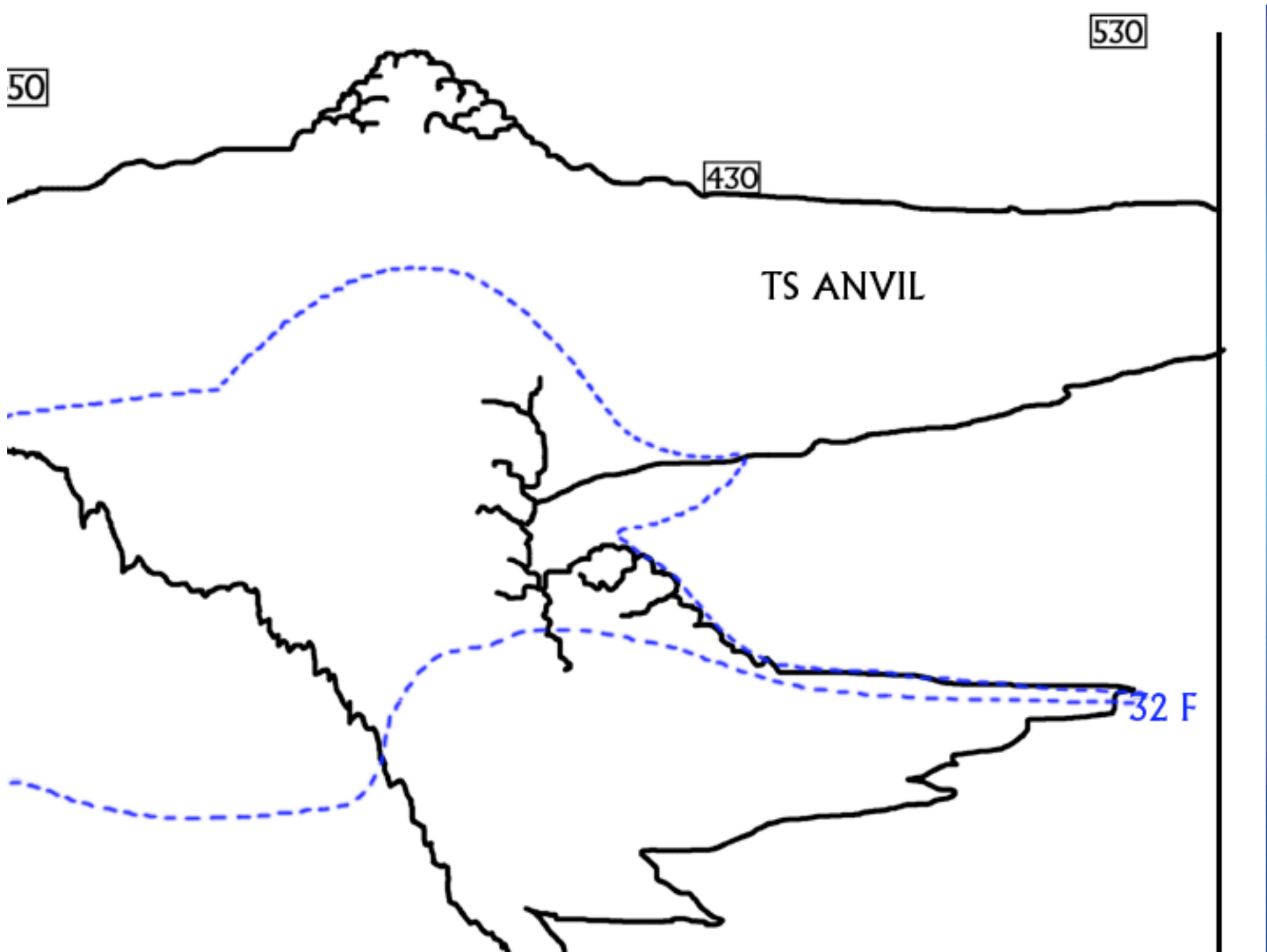
430

TS ANVIL

32 F







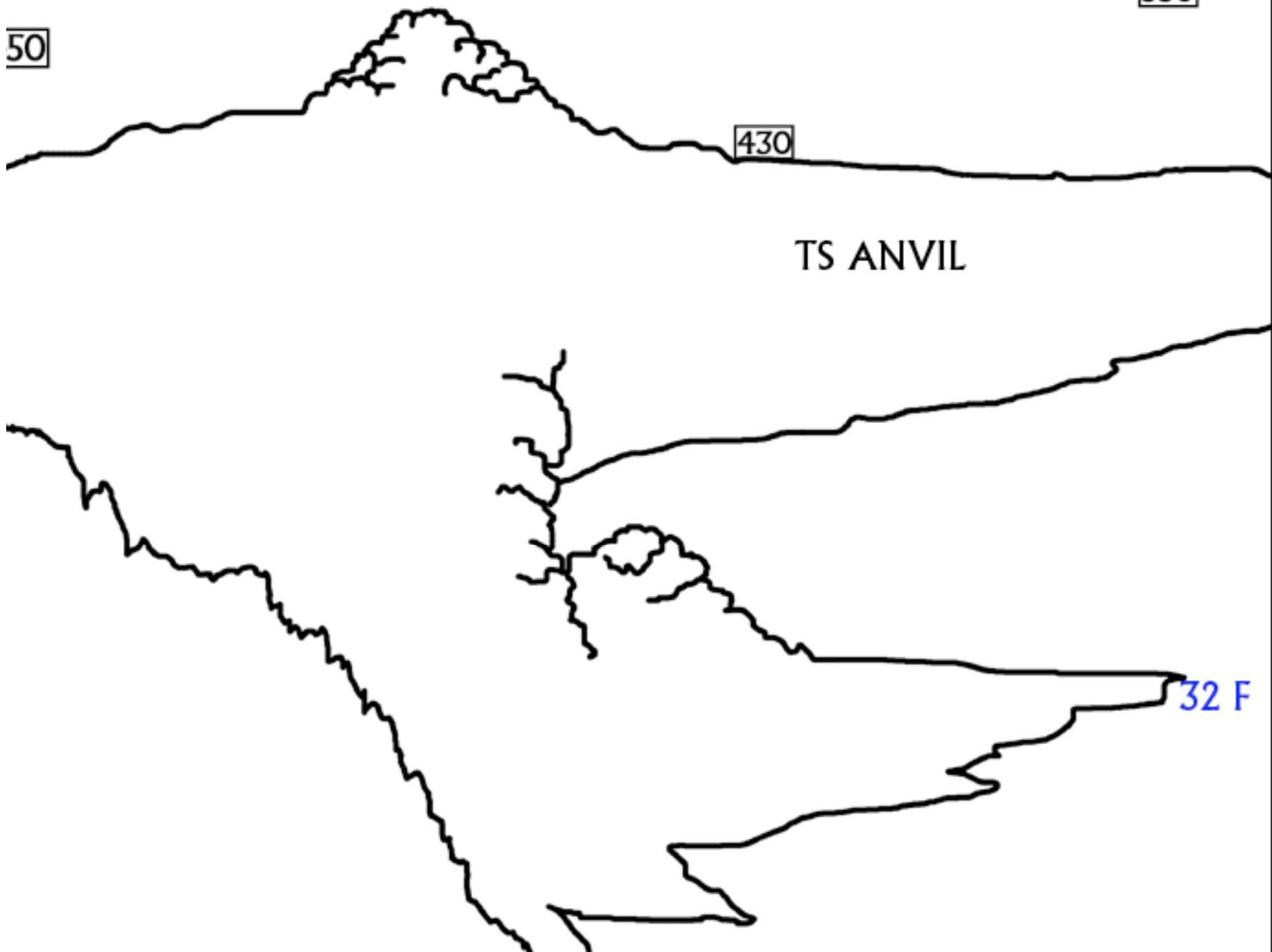
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430

TS ANVIL

32 F



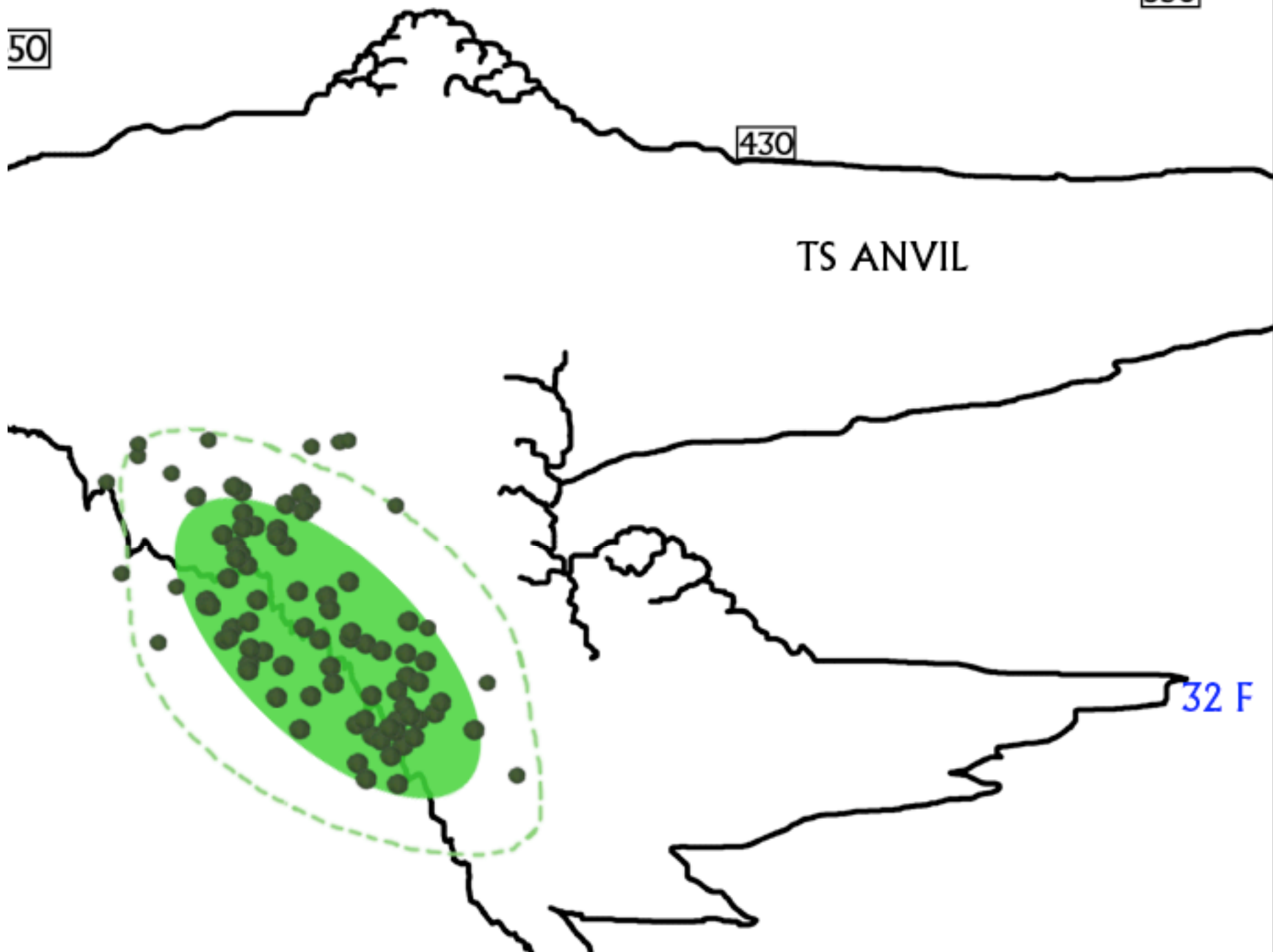
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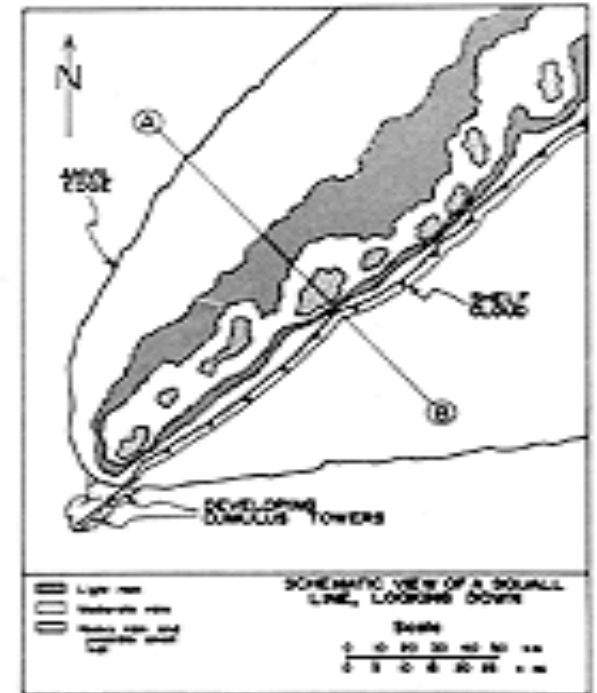
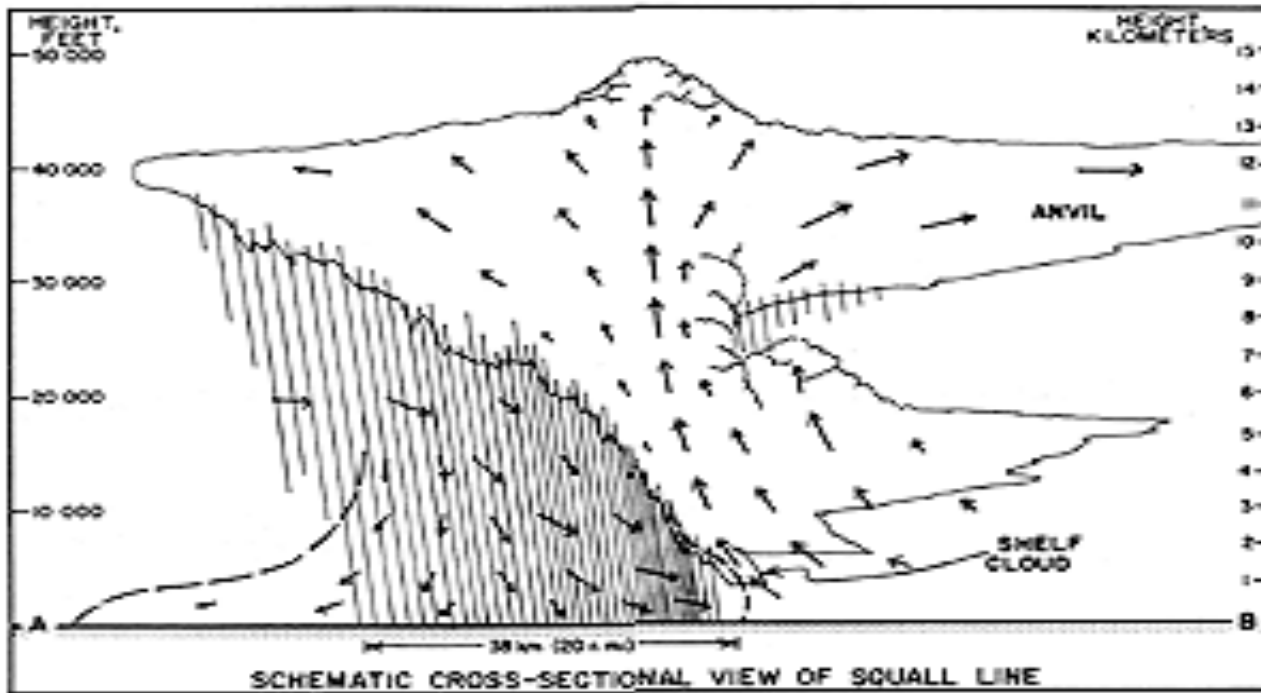
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TS ANVIL

32 F



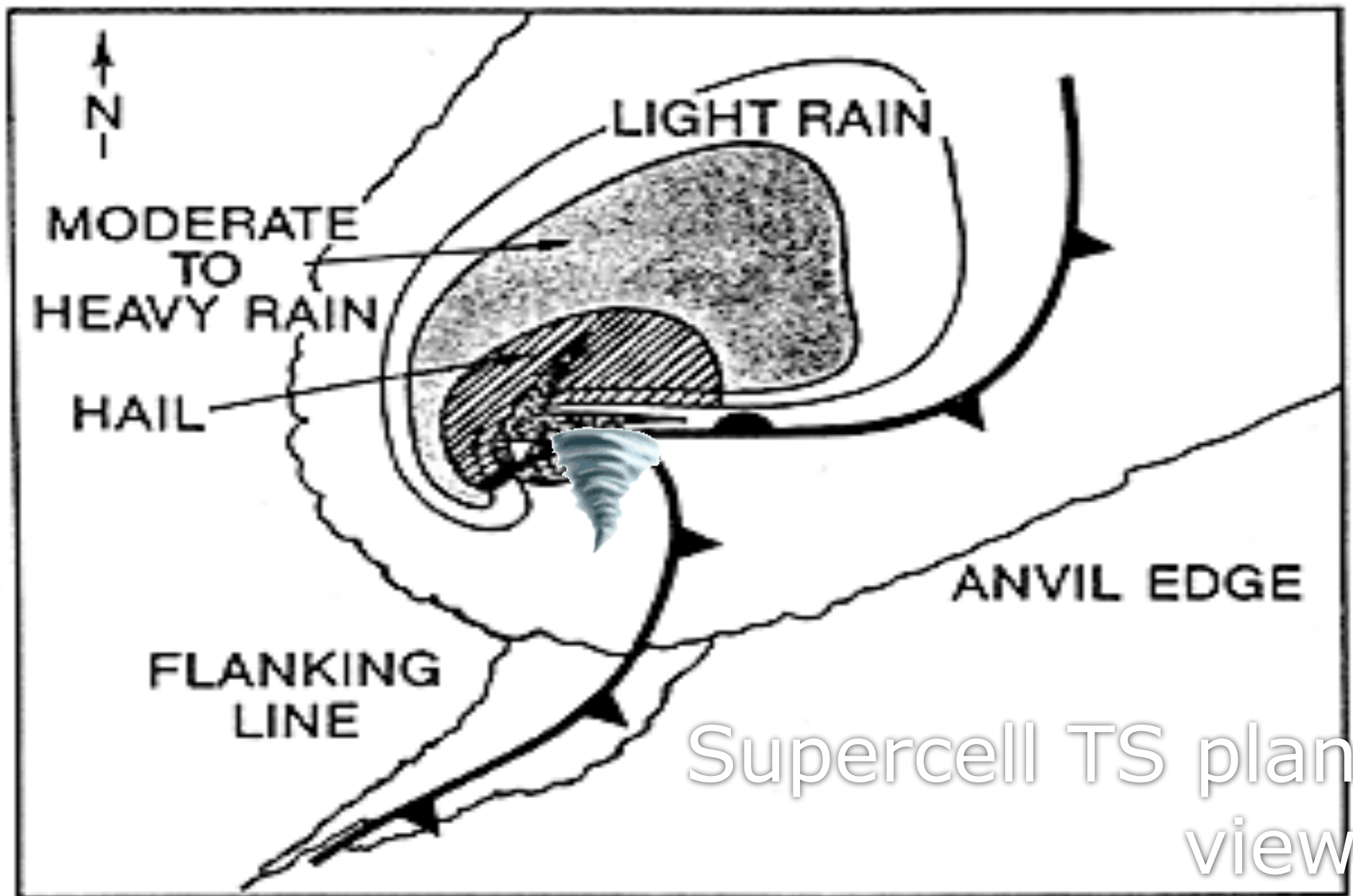
Thunderstorms



- TS contain every known aviation weather hazard!
- FAR 121.419 "Escaping from severe weather situations ...inadvertent encounters...Operating in or near TS, GR, TURB, FC, ICG, etc."
- Supercells, Severe TS, and Microbursts must be avoided!

- Southwest of TS
- Looking Northeast
- Building tower in foreground
- Multicellular storm
- Flanking line under wing extending south



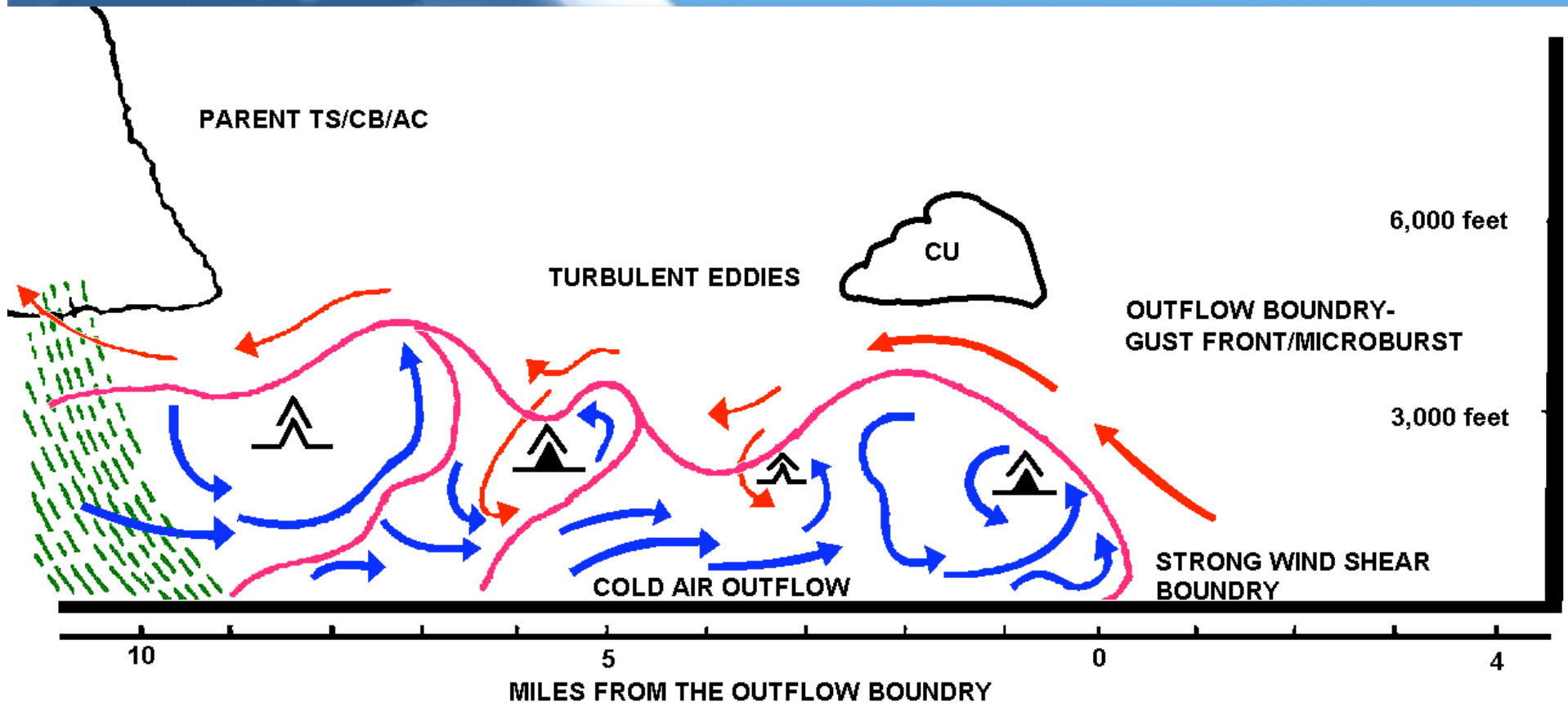




Low Level Wind Shear (LLWS)

- LLWS is a sudden change in wind speed and/or direction below 2000 feet AGL
- TAF LLWS ...
- **VRB004KT P6SM SKC...
WS010/15030**
- Decoded: Wind shear is forecast to occur at 1000 feet AGL due to winds of 150 degrees at 30 knots.
- Since winds are light and variable at the surface pilots could encounter a 26 knot headwind loss when descending through 1000 feet AGL.

OUTFLOW from TS or MB









STATIONARY MICROBURST

"No wind" microburst diagram

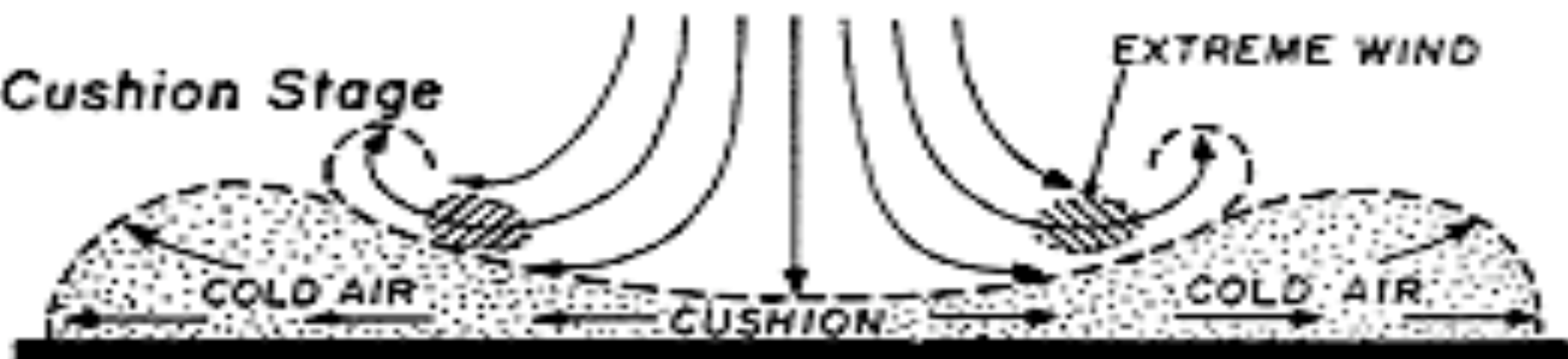
Contact Stage



Outburst Stage



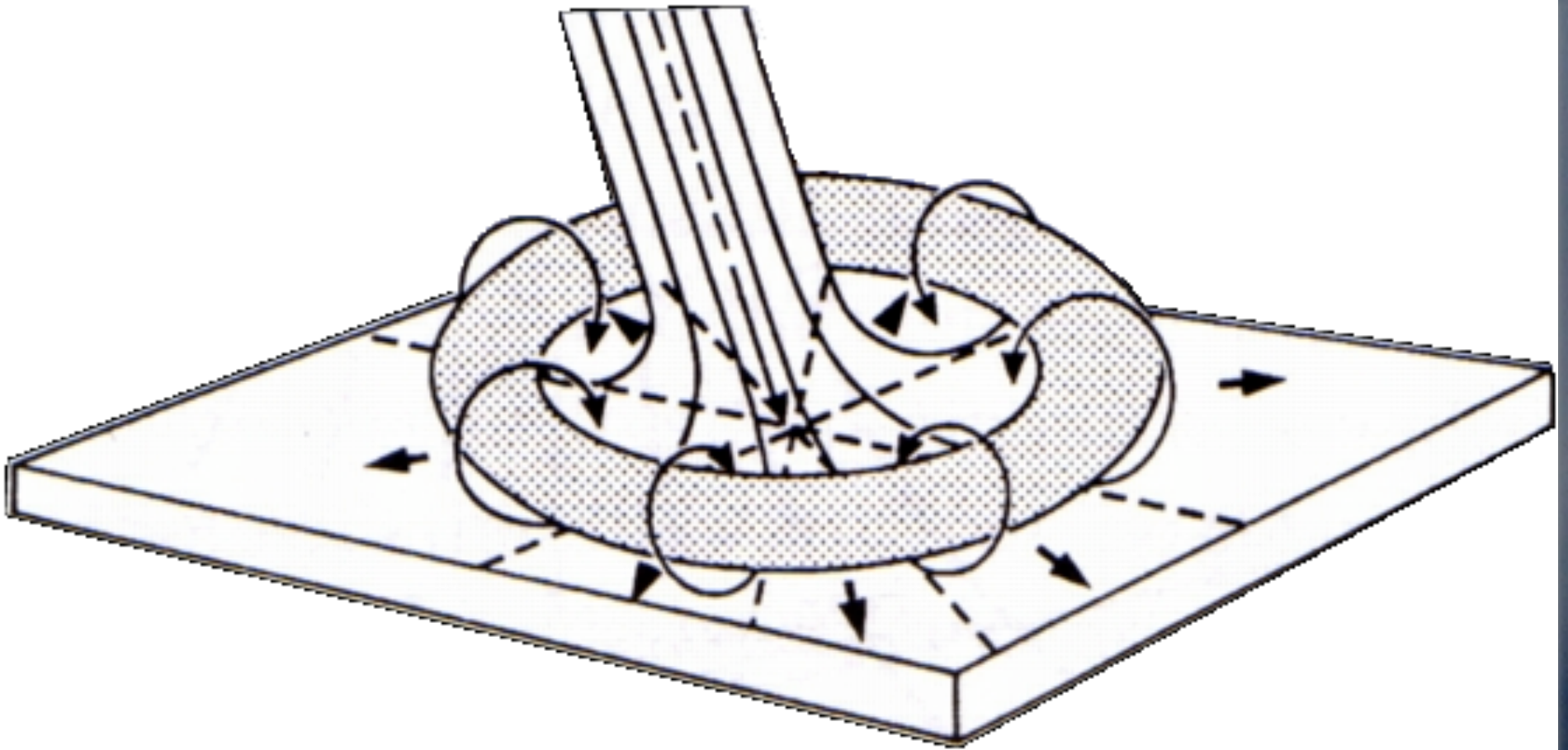
Cushion Stage



DFW MICROBURST

- Wet or Dry Microbursts
 - Wet - TS or SHRA common Midwest-Eastrn US
 - Dry - BLDU, ring shaped dust whirls, VIRGA common Desert Southwest-Rockies KEDW
- Pilot must recognize and avoid
 - 90 seconds to impact
- Danger is tailwind and not the downdraft
- For every knot of tailwind there is a 1-2% loss of lift on the wing ex.-50KTS=no lift!
- Strong ones are not survivable by any aircraft

Microburst footprint



NOAA/NSSL MB PHOTO





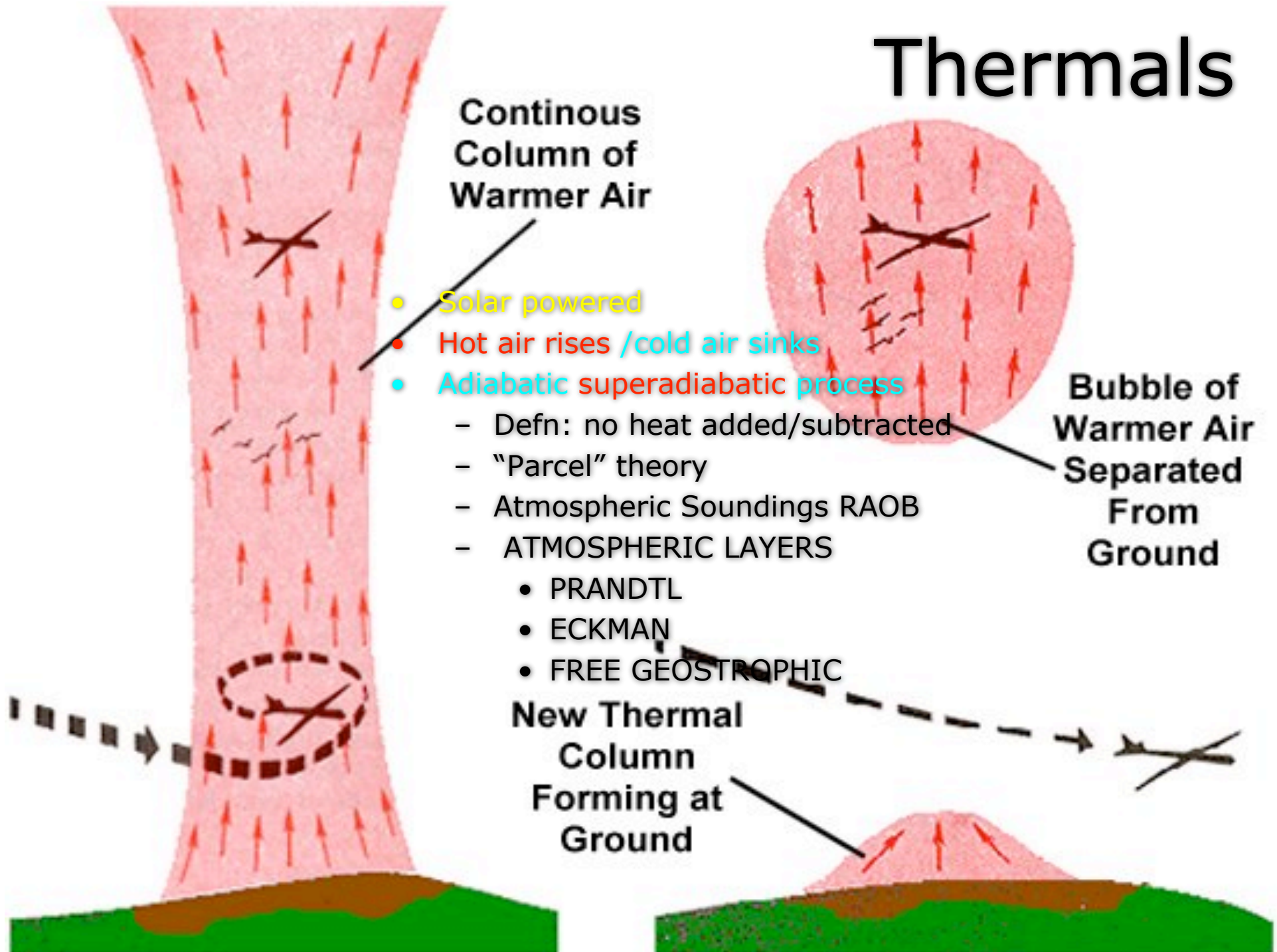


Vertical Atmospheric Motions

- LIFT-Lots of Increased Flight Time
- Types :
 - Thermal
 - Ridge
 - Mountain wave, pressure wave
 - Shear-line, Sea breeze fronts
 - Dynamic Soaring
 - Combo:Thermal/shearline waves
 - Other: Lift is where you find it!



Thermals



Average AV Thermal

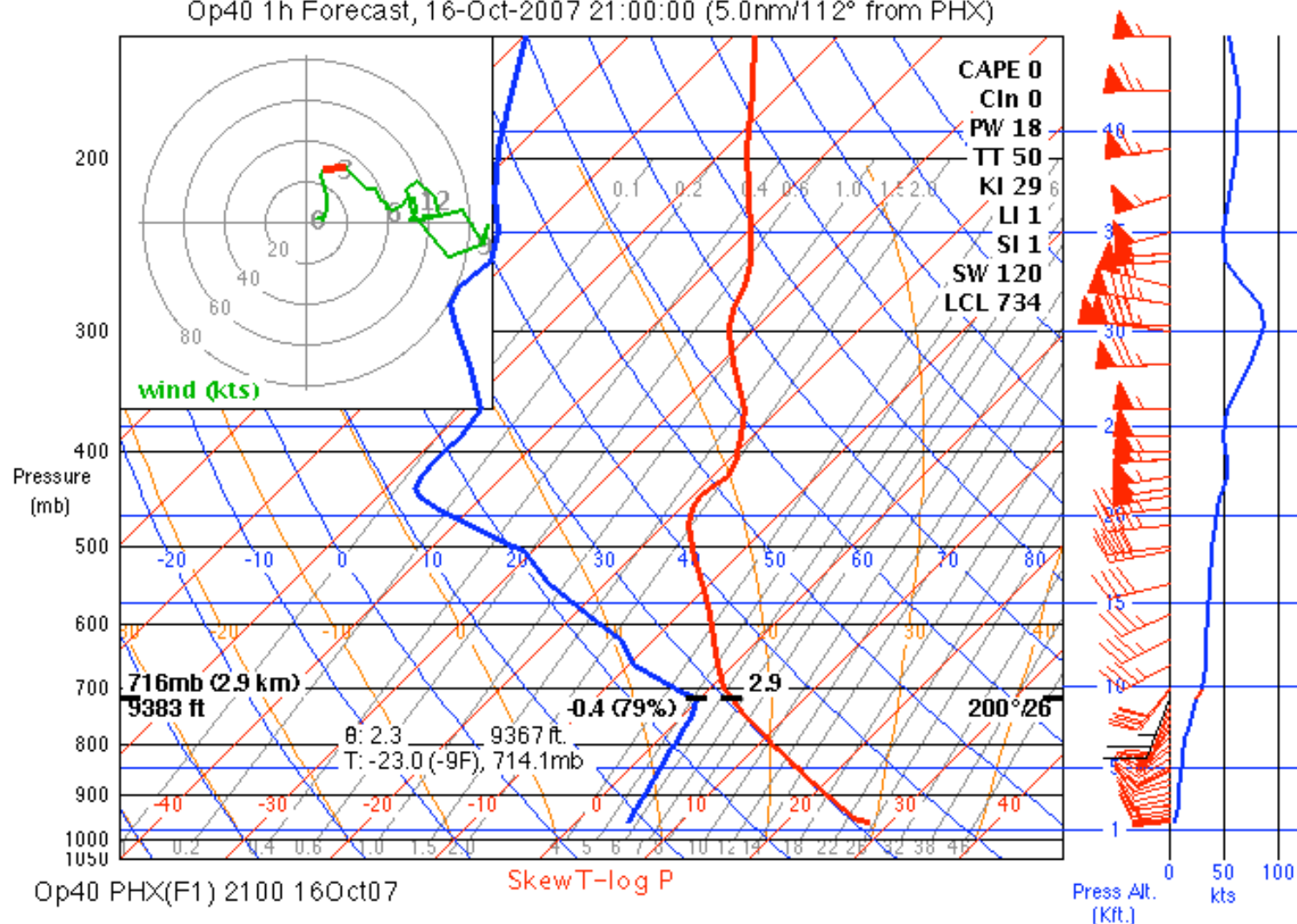




Latest Op40 analysis is valid at **20:00 UTC**.

(You can subscribe to this forum to get email copies of new posts.)

Op40 1h Forecast, 16-Oct-2007 21:00:00 (5.0nm/112° from PHX)



NOAA / ESRL / GSD

Load Soundings

Get text

10mb scale

SkewT/Tephi.

Wind scale: 40/100

PHX(F3) 2300 16Oct07

PHX(F2) 2200 16Oct07

PHX(F1) 2100 16Oct07

PHX(A) 2000 16Oct07